Late results of surgical venous thrombectomy with iliocaval stenting

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Purpose: **Iliac vein occlusive disease leads to 73% of rethrombosis that occurs after venous thrombectomy when left untreated. The goal of this study is to present our long-term results of stenting of iliocaval occlusive lesions persisting after surgical venous thrombectomy.**

Methods: **From November 1995 to April 2007, 29 patients (19 women), with a median age of 38 years, had surgical venous thrombectomy with creation of an arteriovenous fistula and angioplasty and stenting. All were admitted for acute (<10 days) deep venous thrombosis (DVT) involving the iliocaval segment, of which eight had concomitant acute pulmonary embolism. Six patients had a history of DVT (2 with previous venous thrombectomy), two were pregnant, and three had postpartum DVT. No patients had short- or mid-term life-threatening factors. The underlying lesion was left iliocaval compression (May-Thurner syndrome) in 22 patients, chronic left common iliac vein occlusion in 3, residual clot in 3, and compression of the left external iliac vein by the left internal iliac artery in 1.**

Results: **Neither perioperative death nor pulmonary embolism occurred. Four early complications occurred after stenting (13.8%). Median hospital length of stay was 8 days (range, 5-22 days). Median follow-up was 63 months (range, 2-137 months). Three late complications occurred (10.3 %): one rethrombosis due to stent crushing during pregnancy and two restenosis, which were treated by iterative stenting. At the end of the follow-up, the median venous clinical severity score was 3 (range 1-12) and the venous disability score was 1 (range 0-2). Primary, assisted primary and secondary patency rates were, respectively, 79%, 86%, and 86% at 12, 60, and 120 months. Patients with patent iliocaval segments had significantly fewer infrainguinal obstructive lesions (4% vs 50%) and a higher rate of valvular competence (76% vs 0%) than those who experienced rethrombosis. Venous scores were also worse in patients with rethrombosis.**

Conclusion: **Stenting is a safe, efficient, and durable technique to treat occlusive iliocaval disease after venous thrombectomy. Its use can prevent most of the rethrombosis that occurs after venous thrombectomy without major adverse effects. (J Vasc Surg 2008;47:381-7.)**

Deep venous thrombosis (DVT) is a challenging situation. Its treatment should prevent thrombus extension, pulmonary embolism, and long-term venous insufficiency. Although medical treatment achieves prevention of the first two goals, it does not prevent long-term complications, mainly in cases of iliocaval extension of the thrombus. Ziegler et al[1] showed that at a mean follow-up of 6 years after the onset of DVT, 82% of the patients presented with post-thrombotic syndrome.

Venous thrombectomy was first proposed by Läwen in 1938.[2] Its results were improved by some refinements, such as the arteriovenous fistula (AVF) proposed by Kunlin to prevent rethrombosis or the use of a positive end-expiration pressure (PEEP) to prevent pulmonary embolism. We have shown that this technique is safe and associated with good long-term results in term of patency, femoropopliteal valves competence, and freedom of ulceration.[3] However, one of the main concerns with this technique was early rethrombosis. Similar to Mickley et al,[4] we found that iliac vein occlusive lesions left untreated were the first cause of rethrombosis. Stenting is certainly a less invasive way to treat these lesions, and we began to use it in 1995.[5] The goal of this study is to report our late results and to compare them with the literature.

MATERIAL AND METHODS

From November 1995 to March 2007, 35 venous thrombectomies were performed in our department. This technique is indicated in our department for acute and proximal (iliofemoral with or without inferior vena cava [IVC] involvement) DVT. This means that[3]:

- The thrombosis should be <7 days old. Estimation of the age of the thrombus is given by the onset of the first symptoms. The characteristics of the clot at duplex ultrasound (DUS) scan (hypoechogenic and nonadherent clot with dilatation of the vein) and computed tomography (CT) scan (hypodense clot with peripheral enhancement and vein dilatation; Fig 1, *A;* Fig 2, *B*) can help to confirm this.
- The common femoral vein should be completely occluded.
- Patients should be in good condition, with a life expectancy of at least 5 years, and they should not have cancer, sepsis, inflammatory disease by CT scan, or

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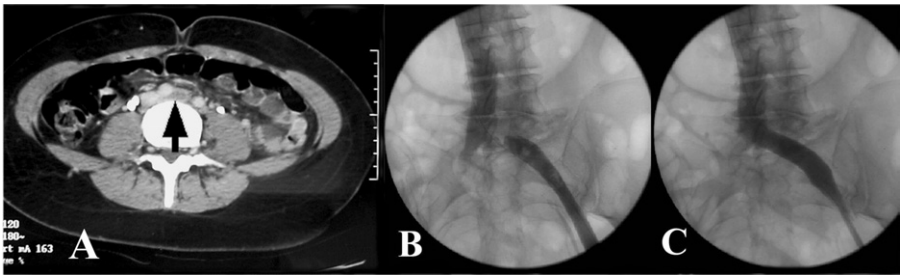

Fig 1. Acute left femoroiliac deep vein thrombosis with stenosis of the left common iliac vein. **A,** Computed tomography angiography shows a stenosis of the left common iliac vein with proximal thrombosis *(black arrow)* and parietal enhancement; the inferior vena cava is free. **B,** Angiography after left iliofemoral surgical thrombectomy shows tight stenosis of the distal left common iliac vein and the presence of residual clot within the vein. **C,** Completion angiography after angioplasty and stenting.

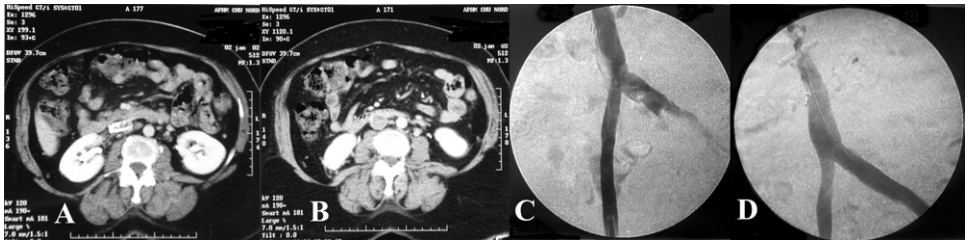

Fig 2. Acute biiliocaval thrombosis in a patient with previous left femoroiliac and inferior vena cava thrombectomy associated with insertion of an inferior vena cava clip. **A,** Computed tomography angiography (CTA) scan at the level of the clip. **B,** In this CTA scan of the proximal inferior vena cava, acute thrombosis can be diagnosed due to parietal contrast enhancement. **C,** Angiography after venous thrombectomy through bilateral common femoral vein approach and thromboaspiration of the inferior vena cava shows presence of adherent clot. **D,** Completion angiography after iterative thromboaspiration and angioplasty and stenting of the left common iliac vein.

severe cardiac or lung disease. They should also be able to be ambulatory the day after the procedure (patients with severe polytrauma, major neurologic deficit, etc. were not considered for venous thrombectomy).

- Pregnancy, postdelivery, and thrombolytic treatment failure are not a contraindication to venous thrombectomy.

The study population comprised 29 patients (19 women), with a median age 38 years (range, 19-72 years), who had iliocaval stenting associated with the surgical thrombectomy. The six earlier cases were already published in previous reports.[5,6]

Six patients had a history of DVT, including two that had been surgically treated: one had a left iliofemoral venous thrombectomy 24 years before, and one had a left iliofemoral and IVC venous thrombectomy with placement of an IVC clip 14 years before (Fig 2).

Among the 19 women, 12 had history of pregnancy, including three who were postpartum, and two who were pregnant. Five women were taking oral contraception. One patient had retroperitoneal fibrosis, one had Cacchi and Ricci disease with JJ catheter insertion 10 days earlier, and four had trauma ≤15 days of the onset of the symptoms. Eleven patients (37.9%) had a contraindication for thrombolysis.

Median American Society of Anesthesiologists (ASA)[7] score was 1 (range, 1-3). The only ASA 3 patient was a 72-year-old man who had no other pathology and was still alive 76 months after the procedure.

All patients were tested for thrombophilia, and a prothrombotic state was found in 10 (Table I). No anomaly was found in a patient with a personal and large familial history of DVT.

Median duration of DVT since symptoms onset was 3 days (range, 1-10 days). No patients had phlegmasia caerulea dolens. In eight cases (27.6%), DVT was associated with pulmonary embolism found by CT scan. None of the patients had a history of malignancy or signs of malignant disease at CT scan.

Diagnosis was confirmed by DUS scan in 24 cases or by thoracoabdominal-pelvic CT angiography scan in 26, or both. Three patients did not have preoperative CT angiography owing to pregnancy in two cases (operation was done on the basis of DUS data only in 1 and after magnetic resonance angiography in 1) and to renal insufficiency due to Cacchi and Ricci disease in one case (DUS scan only). Only three patients had preoperative phlebography (all before 1997).

All patients had left femoroiliac DVT: the left common femoral and external iliac veins were always involved and

Table I. Summary of the results of thrombophilia testing and correlation with other underlying causes

Patient, sex	*Age, y*	*Prothrombotic state*	*Other underlying cause*
Female	25	F II + F V Leyden	Postpartum
Male	46	F V Leyden, hyperhomocysteinemia, and antiphospholipid antibodies	
Female	21	F V Leyden	Postpartum
Female	21	antiphospholipid antibodies	
Female	38	F II + F V Leyden	Postpartum
Female	19	F V Leyden	Oral contraception
Female	39	F V Leyden	Oral contraception
Male	36	F V Leyden, hyperhomocysteinemia, and antiphospholipid antibodies	
Female	67	F II + F V Leyden	
Male	46	F II Leyden	

F II, Factor II Leyden mutation; F V Leyden: factor V Leyden mutation.

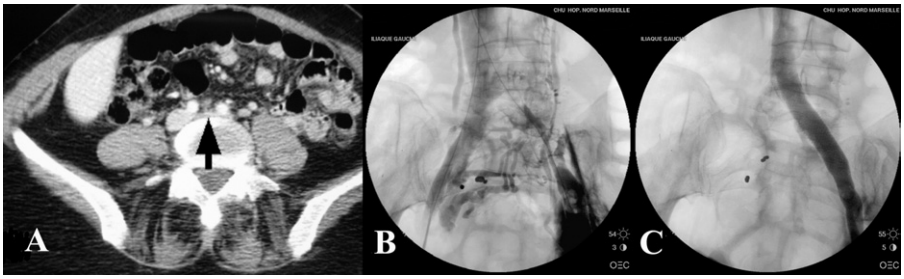

Fig 3. Acute left femoroiliac deep vein thrombosis in a patient with chronic left common iliac vein thrombosis. **A,** Computed tomography angiography scan shows a tight stenosis of the whole left common iliac vein *(black arrow)* without parietal enhancement. Ascending collateral pathways are visible. **B,** In this angiography after venous thrombectomy through left common femoral vein approach, the left common iliac vein is occluded and ascending and transversal collateral pathways are seen. Recanalization was performed with a 0.035-inch guidewire on a guiding catheter. **C,** Angiography shows the result after angioplasty and stenting.

the left common iliac vein in all cases but one. Tibial calf, popliteal, and femoral veins were also thrombosed in all cases but one, who had only common femoral, external, and common iliac veins thrombosis. The right common iliac vein was thrombosed in two patients, including one chronic thrombosis (history of right femoroiliac DVT medically treated). The IVC was involved in seven patients, including two with juxtarenal IVC thrombosis. The patient who had had previous IVC clip placement had acute left femoroiliac and IVC thrombosis, with no clot above the clip (Fig 2). A CT scan also showed left ovarian and renal vein thrombosis in two patients: one had no IVC thrombosis and one had IVC thrombosis and nutcracker syndrome. In all, 151 venous segments were thrombosed, with a median of five segments per patients (range, 2-7 segments). The CTA scan found a tight stenosis at the iliocaval junction in 14 patients (48.3%; Fig 1, *A*). Two patients with a history of DVT had chronic complete left common iliac vein thrombosis (Fig 3, *A*), and one had occlusion due to retroperitoneal fibrosis.[5] In one patient, the left external iliac vein was compressed by the left internal iliac artery.

Surgical technique. The procedure has already been described,[8] but the main steps are summarized.

All procedures were performed under general anesthesia. Before surgery, the patient was cautiously moved and shaved to avoid clot fragmentation and migration that could cause pulmonary embolism. Prophylactic antibiotics were given, and a cell saver device was always used.

Once the common femoral vein was approached, the anesthesiologist was asked to use a positive end-expiratory pressure (PEEP) of 10 cm H_2O during the entire thrombectomy time to prevent pulmonary embolism. A intravenous heparin bolus of 50 UI/kg was given if the patient was already being treated with intravenous heparin; if not being treated, then 100 UI/kg was given.

A 1.5-cm-long venotomy was performed at saphenofemoral junction. Thrombectomy was performed using a large Fogarty catheter, then associated with a Vollmar ring (Aesculap, San Jose, Calif), until no more clots came back. Calf, popliteal, and femoral vein thrombectomy was performed without using any endovenous instrumentation by a sturdy massage of the limb and the thigh. Thrombectomy of the great saphenous vein was done as well, and then the vein was sectioned 10 cm below the saphenofemoral junction.

The venotomy was closed using a 6-0 polypropylene running suture; to prevent stricture, this was tied only after all the veins were unclamped. In case of IVC involvement, thrombectomy was performed using a right subcostal approach before the extremity thrombectomy.

A sheath was then introduced through the great saphenous vein and completion iliocavography was performed

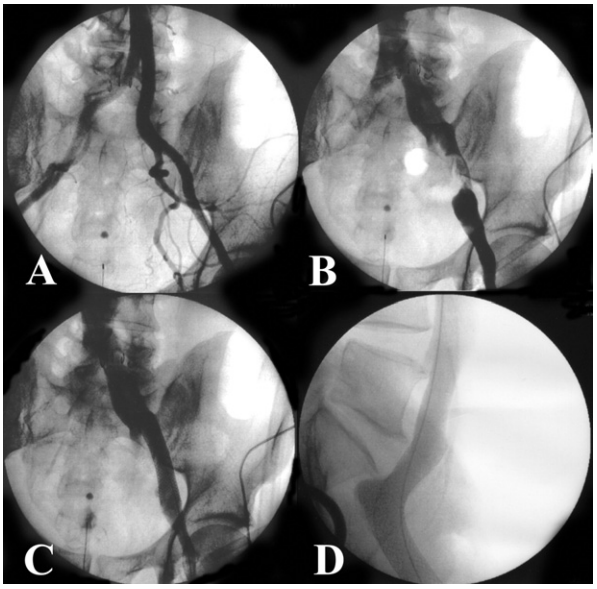

Fig 4. Acute left femoral-external iliac deep venous thrombosis. **A,** Arteriography. **B,** Iliocavography after venous thrombectomy shows a major compression of the distal end of the left external iliac vein. **C,** Face iliocavography after stenting. **D,** Profile iliocavography after stenting.

(Fig 1, *B*; Fig 2, *C*; Fig 3, *B*; Fig 4, *B*). If an obstructive lesion was found (stenosis, occlusion, or residual adherent clot), the vein was catheterized with a 0.035-in guidewire and angioplasty was performed, generally using 12-mm-diameter balloon. Self-expanding stents (Wallstent, Boston Scientific-Schneider, Minneapolis, Minn) were deployed protruding into the IVC and then dilated with a 15-mm balloon before completion angiography (Fig 1, *C;* Fig 2, *D*; Fig 3, *C;* Fig 4, *C* and *D*). The AVF was then performed with an end-to-side anastomosis between the superficial femoral artery and the great saphenous vein or with a 5-mm polytetrafluoroethylene graft if the vein was unsuitable.

A bilateral elastic stocking was placed, and the intravenous heparin infusion was continued. As soon as the patient was awake, active mobilization was performed. We asked the patient to begin walking from day 1. Long-term anticoagulation with fluindione was started the first postoperative day and continued for at least 6 months, and the AVF was surgically closed at 6 weeks.

Follow-up. Angiography was always performed at during AVF closure at 6 weeks. Patients were scheduled for clinical examination and DUS scanning at 1, 3, and 6 months, and then each year thereafter. The venous clinical severity score (VCSS) and venous disability score (VDS)[9] were evaluated during the follow-up to assess clinical results. In case of clinical recurrence of the symptoms or of restenosis on color Doppler US (>50% in-stent restenosis or inflow obstruction is considered significant), transfemoral percutaneous venography was performed. Valvular incompetence was defined by DUS scan evaluation as reflux of >0.5-second duration during a Valsalva maneuver against a 40-mm Hg column with the patient in an erect position. Severity of the reflux was assessed according to Kistner et al[10] phlebographic grading.

Statistical analysis. Primary, assisted primary, and secondary patency rates were calculated using survival analysis with the life-table method from the date of stenting. Nonparametric tests were used, with the Mann-Whitney *U* test for continuous data and the Fisher exact test for categoric data when comparing the two groups of patients.

RESULTS

Four patients did not have angiography or stenting during surgical thrombectomy, the first two cases, which were both stented percutaneously before discharge, and the two pregnant women. One had rethrombosis at day 1 and had iterative thrombectomy, angiography, and stenting[5]; the other underwent stenting after delivery. Iliocavography found obstructive lesions in all patients: May-Thurner syndrome in 22 (Fig 1, *B*), common iliac occlusion in 3 (2 chronic lesions [Fig 3, *B*] and 1 retroperitoneal fibrosis), residual clot in 3 (Fig 2, *C*), and compression of the external iliac vein by the internal iliac artery in 1 (Fig 4, *A* and *B*).

Balloon-expandable stents were used in two patients, the first patient and a pregnant woman.[5] In this last case, this stent was chosen to decrease irradiation (10 seconds for angiography before and after stent deployment). All other stents were self-expanding Wallstent. Six patients received two stents. The median length of stented vein was 60 mm (range, 30-120 mm) with a median 16-mm diameter (range, 12-16 mm). All stents but the two balloon-expandable stents protruded into the IVC. No stent extended below the inguinal ligament.

During the same procedure, a JJ catheter was inserted for left ureteral dilatation due to retroperitoneal fibrosis in one patient, and a patient who had left arm traumatic amputation a few days before had surgical redo of the stump. In addition, the patient with infrarenal IVC, left ovarian, and left renal vein thrombosis with a nutcracker syndrome had left renal vein thrombectomy and transposition during IVC thrombectomy. The patient who had an IVC clip was treated by a left femoral approach and thromboaspiration of the IVC with an 8F guiding catheter (Fig 2).

No procedural complications occurred, but four patients (13.8%) had early postoperative complications after stenting. One patient with history of previous left femoroiliac DVT had rethrombosis at day 1. Iterative thrombectomy was performed with endophlebectomy of the common femoral vein and stenting of the entire external iliac vein. The proximal external iliac vein ruptured and was ligated, leading to complete iliac rethrombosis (no covered stent was available at this time). In the patient who had previous iliocaval thrombectomy and IVC clip, the prosthetic AVF and the whole left iliac vein thrombosed at day 4, but the thrombectomized right iliac veins and the IVC remained patent. The AVFs thrombosed postoperatively in two patients; both had patent veins at DUS scan when discharged, but one had rethrombosis at day 15.

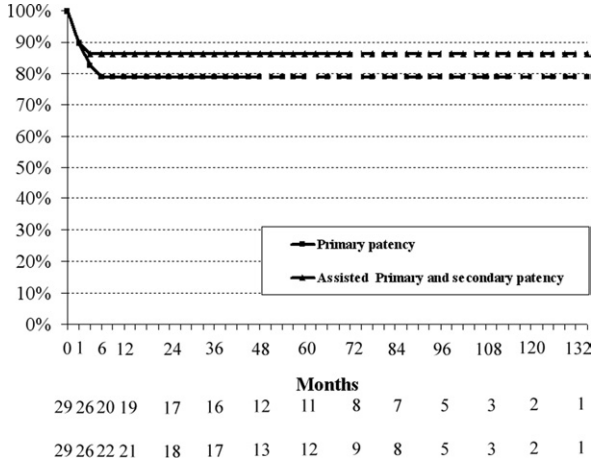

Fig 5. Primary, assisted-primary, and secondary patency rates after venous thrombectomy and stenting of 24 patients who had venous thrombectomy (intention to treat). Standard error was >10% at 48 months for primary patency, at 69 months for assisted-primary and secondary patency (the curves are represented as dotted lines when SEM is >10%).

None of the patients who had only left femoroiliac thrombectomy needed a blood transfusion. A blood transfusion was needed perioperatively or postoperatively in six patients (20.7%): the patient who had external iliac vein rupture, along with four who had IVC thrombectomy and one who had iterative iliofemoral thrombectomy.

All patients were discharged with fluindione therapy and elastic stockings. The median length of stay was 8 days (range, 5-22 days).

Median follow-up was 63 months (range, 2-137 months). No patients died or had pulmonary embolism during the entire follow-up. At 6 weeks, 26 AVFs were closed surgically without complications, except in the pregnant patients, which were closed postpartum. Originally, 30 AVFs were constructed (one bilateral), but three occluded ≤1 month and one occluded at 2 months in a pregnant patient. Venous complications occurred during follow-up in three patients. The pregnant patient who had a balloon-expandable stent had rethrombosis 2 months later (seventh month of pregnancy) due to stent crushing.[5] A Palma procedure was performed 6 months after delivery, which was still patent 66 months later. Two other patients needed iterative stenting for proximal restenosis at 2 and 4 months, respectively.

Primary patency rates were 89.7% at 1 month and 78.9% at 12 and 60 months (Fig 5). Assisted primary and secondary patency rates were 89.7% at 1 month and 86.1% at 12 and 60 months. At the end of follow-up, the median VCSS was 3 (range, 1-12) and VDS was 1 (range, 0-2) but were lower in patients with a patent iliocaval segment (Table II). In addition, DUS examination found significantly less obstruction on the infrainguinal veins in patients with a patent iliocaval segment (1 case only, 4%) than in patients who had iliac rethrombosis (50%; $P = .0421$; Table II). Reflux was present in all patients who had iliac rethrombosis compared with six of the 25 patients (24%) with patent iliocaval segments ($P = .00884$; Table II). Of these, three had grade III reflux: one had a thrombectomy at day 10, and one had undergone thrombectomy 24 years before.

Table II. Results of the thrombectomy on infrainguinal veins at duplex ultrasound scan and correlation with venous scores

	Iliocaval segment		
Result	*Patent (n = 25)*	*Rethrombosed (n = 4)*	P
Obstruction, No.	1	2	.0421
Reflux, No.	6	4	.00884
Grade I	1	0	
Grade II	2	0	
Grade III	3	3	
Grade IV	0	1	
Venous scores, mean (range)			
VDS	3 (2-8)	8 (7-12)	.006106
VCSS	0 (0-2)	2 (1-2)	.002335

VDS, Venous disability score; *VCSS,* Venous clinical severity score.

DISCUSSION

Results of surgical venous thrombectomy have been extensively reported and discussed. The results are good when performed by trained teams,[3-4,11-13] with mortality rates of 0% to 1%, low morbidity rates, and good long-term results for patency and valvular competence.[3,11-12] Moreover, construction of an AVF was shown to reduce acute rethrombosis[14] and pulmonary embolism.[15] It can be also safely performed during pregnancy, as reported by Pillny et al.[16]

One of the main concerns with this technique was the risk of early rethrombosis. Juhan et al[3] and Mickley et al[4] demonstrated that this complication was mostly due to the presence of stenotic lesions, whatever their cause, including extrinsic compression, luminal webs, or residual clot. Mickley et al[4] reported that such stenotic lesions led to 73% of rethrombosis if left untreated. In our previously reported experience,[3] it occurred in 7% of the cases without stenosis, in 26% of those with mild stenosis, and in 56% of cases of tight stenosis. In such cases, reports recommended repeat thrombectomy (despite the high risk of iterative thrombosis)[3] or to perform a bypass, the Palma procedure being the technique of choice owing to its relatively low invasiveness compared with the other surgical possibilities.

Stenting has documented safety and effectiveness in the treatment of chronic lesions.[17,18] The goal of stenting during interventional procedures for DVT is to treat the lesions that compromise patency while avoiding a long and complex concomitant procedure. This endovascular procedure can be performed during surgical thrombectomy and usually requires about 10 minutes to be completed. In contrast, Wohlgemuth et al[19] reported stenting at a mean 4.1 months after thrombectomy during AVF surgical clo-

Table III. Comparison of the results of venous thrombolysis and venous thrombectomy for acute deep venous thrombosis

First author	*Technique*	*No.*	*Technical success, %*	*Primary patency, %*		*Late SP, %*
				At 12 months	*Late*	
O'Sullivan[23]	TL	19		Stent +: 92		
Mewissen[22]	TL	144	88 >50% of lysis	Stent−: 53; Stent+: 74		
Bjarnason[24]	TL		86	Stent−: 75; Stent+: 54		
Comerota[25]	TL	58	84	Stent−: 71; Stent+: 89		
Patel[27]	TL	10	100			
AbuRahma[28]	TL	10	90			
Vedantham[26]	MT + TL	14	100			
Kwak[29]	MT + TL	22	96	95	24 mo: 95	24 mo: 100
Mickley[4]*	ST	8	95	73	24 mo: 73	24 mo: 82
Wohlgemuth[19]*	ST	35	97	76	48 mo: 66	48 mo: 69
Schwarzbach[30]*	ST	20	100		21 mo: 80	21 mo: 90
Husmann[31]	ST	11	100	82	22 mo: 82	22 mo: 91
Hartung[17]*	ST	29	100	79	60 mo: 79	60 mo: 86

SP, Secondary patency rate; *ST,* surgical thrombectomy and arteriovenous fistula; *TL,* thrombolysis; *MT,* mechanical thrombectomy.
*Intention to treat.

sure. This approach, however, has two adverse effects: It does not protect as well as concomitant stenting against early rethrombosis, and this delay before AVF closure is too long. Indeed, a long-standing AVF can be associated with distal common femoral vein stenosis, as Wohlgemuth et al[19] noted: 67% of stenoses were located immediately proximal to the origin of the AVF. This is why AVF closure should be performed at 6 weeks, experimental studies having shown that vein reendothelialization is nearly complete ≤4 weeks.[20] Technical tips for stenting were already discussed in a previous report.[17]

Although AVF construction was shown to be effective during venous thrombectomy,[11] some authors have restricted its use since the introduction of contemporary stenting during the surgical procedure,[13,21] arguing that there should be no more obstructive lesions after stent implantation. We agree, but the goal of the AVF is also to keep the vein patent during the time needed for reendothelialization of the thrombectomized vein and endothelialization of the stent. Moreover, in our experience, two patients needed iterative stenting during AVF closure, and it could be argued that the AVF protected them from rethrombosis.

The results of surgical thrombectomy associated with stenting show that this approach can provide the same postoperative results as venous thrombectomy in patients without obstructive lesions. In our experience, rethromboses occurred at least in two patients who were not the best candidates for the technique (iterative thrombectomy, thrombectomy on diseased veins after previous iliofemoral DVT). The last case remains unexplained, because the patient refused an iterative procedure after AVF thrombosis as well as after vein rethrombosis 13 days later.

Mortality and morbidity with this approach were very low compared with results reported by Mewissen et al[22] using thrombolysis, with major bleeding, 11%; major neurologic complications, 0.4%; pulmonary embolism, 1%, and death, 0.4%. Moreover transfusion was not needed in patients without a history of ipsilateral iliofemoral DVT and without IVC involvement. Surgical thrombectomy also provided a high technical success rate (always >95% in the literature), which overtakes those of thrombolysis (Table II),[22-29] but patency rates at 1 year are similar for both approaches (Table III).[22-31] Various contraindications limit the applicability of percutaneous techniques, which was 75% in our previously published experience,[3] and 38% in this report. Contraindications to the adjunctive stenting are sepsis (if not also a contraindication to venous thrombectomy) and pregnancy. In pregnant women, stenting should be performed after delivery; but in case of early rethrombosis, the use of a self-expanding stent should be considered despite the need for longer irradiation time.

A major issue with this approach is late results. One thrombosis occurred at 2 months and was linked with the use of a balloon-expandable stent in a pregnant patient, confirming, if needed, that self-expanding stents represent so far the best technology to treat venous lesions. Two early restenosis occurred and were treated by iterative stenting. It seems that they were due to the delivery of 40-mm stents that were too short and did not cover the whole lesions.

It is noteworthy that no other complications influencing patency have occurred so far after the fourth postoperative month. With a median of 63 months, we report the longest follow-up after such procedures, to our knowledge. Our results are consistent with those of the literature regarding surgical venous thrombectomy with stenting of iliac obstruction[4,19,30-31] and are comparable with those we had in a former report,[3] including patients with or without obstructive lesions. It is not possible to compare these long-term results with those of thrombolysis because all authors but one report follow-up of only 12 months.[23-28] Kwak et al,[29] with a mean 21 months of follow-up, reported a 95% primary patency rate and 100% secondary patency rate at 24 months. Furthermore, com-

petence and patency rates of infrainguinal veins are significantly higher in patients whose iliocaval segment remained patent. These data are confirmed by venous scores that show that these patients were not disabled, or only minimally so. On the other, hand all patients who had rethrombosis had reflux grade III or IV and had higher venous scores.

CONCLUSION

Stenting provides considerably improved results with good long-term patency rates in patients with underlying stenotic lesions who have surgical thrombectomy with construction of an AVF. It also avoids most of the rethromboses and post-thrombotic syndrome. These data, if confirmed by larger studies, should lead to reconsideration of surgical thrombectomy to treat acute DVT with iliocaval extension.

AUTHOR CONTRIBUTION

Conception and design: OH
Analysis and interpretation: OH, FB, PB, MB
Data collection: OH, FB, PB, MB
Writing the article: OH, FB
Critical revision of the article: OH, PB, YA
Final approval of the article: OH, YA
Statistical analysis: MD, OH
Obtained funding: Not applicable
Overall responsibility: OH, YA

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