CLINICAL STUDY

Stent Extension below the Common Femoral Vein in Extensive Chronic Iliofemoral Venous Obstructions

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ABSTRACT

Purpose: To analyze whether primary venous stent placement into 1 dominant inflow vein peripheral to the common femoral vein (CFV) confluence is feasible.

Materials and Methods: Retrospective review was performed of 14 consecutive patients who underwent primary venous stent placement into veins peripheral to the CFV between 2013 and 2016. Mean patient age was 49 years; 6 (43%) patients were women. All patients had successful deep venous stent placement with brisk contrast flow through the stent. Patients had primary percutaneous stent placement when postthrombotic changes extended peripherally to the femoral confluence but a trabeculation-free area in the deep femoral vein (DFV) could be identified. Based on imaging findings, the DFV had to be considered the prominent inflow vein with normal anatomy. Femoral vein, DFV, and collateral inflow were minimally impaired owing to postthrombotic scarring or trabeculations.

Results: Primary, assisted primary, and secondary patency rates were 92% at a median follow-up of 481 d (range, 411–792 d). Venous Clinical Severity Score decreased from a mean of 8.9 to 6.4 ($P = .03$). The Villalta scale decreased from a mean of 11.7 to 4.3 ($P = .003$). Before intervention, venous claudication was present in 92% and remained in 38% after intervention ($P = .016$).

Conclusions: Stent placement through the femoral confluence into a dominant inflow vein is a promising option in a carefully selected group of patients.

ABBREVIATIONS

AVF = arteriovenous fistula, CFV = common femoral vein, DFV = deep femoral vein, FV = femoral vein

Postthrombotic syndrome is a debilitating, frequently long-term complication following a deep vein thrombosis (1,2). Treatment of postthrombotic obstruction peripheral to the inguinal ligament and involving the femoral confluence in particular remains a challenge and is not specifically addressed by most guidelines (3). As venous inflow may be insufficient to support stent patency in such cases, a hybrid procedure combining endophlebectomy and arteriovenous fistula (AVF) might be a good alternative to an endovascular procedure. Small cohort series have shown favorable results in patients for whom alternative interventional treatment options were deemed suboptimal (4–7); however, the number of complications and reinterventions is considerably higher compared with percutaneous treatment alone. First, owing to the open surgical procedure, wound infections and wound dehiscence can occur. Second, compression from hematomas or lymphoceles in the recently operated common femoral vein (CFV) may negatively affect primary patency. Third, the AVF may potentially induce intimal hyperplasia and in-stent stenosis (4,8).

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It seems ideal to keep open surgical therapy to a minimum and choose a minimally invasive intervention when possible. The main challenge is to select patients in whom a nonfibrotic venous segment can be found for stent placement, a practice that adheres to the widely held belief that stent placement should be performed "from healthy to healthy" (9). The potential of this strategy is supported by earlier results showing bailout stent placement into a single inflow vein to be a feasible option after primary hybrid surgical intervention with secondary patency rates of 70% (10). The aim of this study was to analyze whether primary venous stent placement into a dominant inflow vein peripheral to the CFV confluence is feasible in selected cases.

MATERIALS AND METHODS

This study was approved by the local institutional review board and ethical committee. Between July 2013 and January 2016, 79 patients were treated for postthrombotic changes extending peripherally to the CFV. All patients underwent successful stent placement. In 65 (82%) patients, a hybrid procedure combining endophlebectomy and AVF was performed to increase inflow into the stents. In 14 (18%) patients, primary stent placement peripheral to the femoral confluence was performed, and these patients were included in this study.

All consecutively included patients presented with substantial clinical symptoms, such as pain, edema, and venous claudication, that interfered with daily activities. In patients with minimal clinical signs, the presence of venous claudication was the main indication for treatment. In all patients, both duplex ultrasound (US) and magnetic resonance (MR) venography revealed signs of postthrombotic stenosis, trabeculations, or scarring. Baseline characteristics, such as age, sex, side of treatment, and clinical scores, were retrospectively analyzed and entered into a database. Patency rates and complications were analyzed for all included patients.

Selection Criteria for Primary Stent Placement Peripheral to the Femoral Confluence

All patients were treated by an interventional radiologist. Treatment planning was based on a multidisciplinary consultation between the radiologist and 2 vascular surgeons. Before intervention, eligible patients underwent evaluation of postthrombotic obstructions by duplex US and MR venography. Based on the extensiveness of postthrombotic scarring and collateral venous flow, patients were treated with either a hybrid surgical intervention or percutaneous stent placement. When obstruction extended peripherally to the femoral confluence, especially when the CFV was occluded or when there was a risk that stent placement could displace intraluminal tissue and compromise the inflow of the femoral vein (FV) or deep femoral vein (DFV), a hybrid procedure with endophlebectomy and AVF was preferred. Also, when the orifices of the FV and/or the DFV were occluded, patients were included in the hybrid surgical treatment group. These patients were excluded from analysis in this study, as the goal was to analyze the outcome of stent placement peripheral to the femoral confluence into 1 inflow vein.

Patients had primary percutaneous stent placement when postthrombotic changes extended peripherally to the femoral confluence but a trabeculation-free area in the DFV could be identified. Based on imaging findings, the DFV had to be considered the prominent inflow vein with normal anatomy. Furthermore, the inflow from the FV, DFV, and collaterals needed to be minimally impaired owing to postthrombotic scarring or trabeculations (**Table 1**).

The demographics of all included patients are shown in **Table 2**. Mean patient age was 49 years, and 43% of patients were women. All patients had successful deep venous stent placement with brisk contrast flow through the stent without significant stenosis.

Intervention

After traversing the postthrombotic trabeculations, transluminal angioplasty was performed generally using a 16-mm balloon for the common iliac vein, a 14-mm balloon for the external iliac vein, and 12-mm balloon for the FV and/or DFV. Thereafter, stents were deployed, and dilation of the stents was performed after deployment. A 14-mm or 16-mm sinus-Obliquus stent (Optimed GmbH, Ettlingen, Germany) was placed in bilateral iliac veins. A 14-mm or 16-mm sinus-Venous stent (Optimed GmbH) was placed in unilateral iliac veins. The stents were extended into the dominant inflow vein with highest quality and flow. The diameter of this target vein needed to be at least 10 mm to enable deploying a 10- to 12-mm stent. This was tested by balloon occlusion of the CFV with administration of contrast medium directly into the DFV (**Fig 1a–d**). Sufficient inflow was deemed as an arbitrary cutoff of contrast washout of 4 seconds.

Follow-up

After intervention, intermittent pneumatic compression stockings were applied when the patient was immobilized. All patients were evaluated before hospital discharge and at 2 weeks, 6 weeks, 3 months, 6 months, and 12 months after intervention. During every follow-up visit, stent patency was evaluated, and clinical outcomes were determined based on the Venous Clinical Severity Score, Villalta scale, and presence or absence of venous claudication. Stent patency was evaluated by duplex US and documented as patent (showing any blood flow through the stents) or occluded. Stenosis was documented based on the percentage of lumen reduction. When the detected stenosis was $>$ 50% and clinical symptoms recurred or worsened over time, an additional treatment was discussed.

After initial treatment, all patients received low-molecular-weight heparin and warfarin therapy simultaneously until an international normalized ratio of 3–4 was reached. Warfarin