CLINICAL STUDY

Technical Details and Clinical Outcomes of Transpopliteal Venous Stent Placement for Postthrombotic Chronic Total Occlusion of the Iliofemoral Vein

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ABSTRACT

Purpose: To evaluate the technical aspects and early clinical results of stent placement for managing postthrombotic chronic total occlusion (CTO) of the iliofemoral vein through ipsilateral popliteal access.

Materials and Methods: A retrospective analysis of 110 patients (44 men; mean age, 51 y; 118 limbs; 102 left limbs) with postthrombotic CTO of the iliofemoral vein treated with stent placement in a single institution from January 2007–December 2011 was conducted. All occlusions were initially accessed via ipsilateral popliteal veins under the guidance of venography or ultrasonography. Technical aspects, quality of life, stent patency, and Villalta scores were recorded at follow-up evaluation. Risk factors of in-stent restenosis and early in-stent thrombosis were evaluated using Cox proportional hazards regression model.

Results: Percutaneous recanalization was successful in 112 of 118 limbs (95%). The mean duration of the procedure was 43 minutes (range, 10–120 min). The quality of life and Villalta scores were significantly improved ($P < .01$). The 3-year primary, assisted primary, and secondary cumulative stent patency rates were 70%, 90%, and 94%. During a median follow-up period of 25 months (range, 1–52 mo), the relief rates of severe leg pain (visual analog scale > 5) and severe leg swelling (grade 3) were 72% (49 of 68) and 70% (64 of 91), respectively, and the healing of ulcers was successful in 78% (36 of 46) of the cases. After stent placement, the limbs with visible remaining collateral circulation had a higher rate of early in-stent thrombosis (22.5% vs 6.1%; $P = .007$). The patients with long stents extending below the inguinal ligament had a higher rate of in-stent restenosis (hazard ratio = 1.77–6.5; $P = .0146$).

Conclusions: Transpopliteal venous stent placement is an effective, safe, and feasible method of managing postthrombotic CTO of the iliofemoral vein. The stent extending below the inguinal ligament is the major risk factor of in-stent restenosis. The visible remaining collateral circulation after stent placement may indicate persistent hemodynamically significant stenosis.

ABBREVIATIONS

CTO = chronic total occlusion, PTS = postthrombotic syndrome

Despite the widespread usage of anticoagulants, postthrombotic syndrome (PTS) is the most common complication encountered in deep vein thrombosis, developing in 20%–50% of patients after a proximal deep vein thrombosis, and is severe in 5%–10% of cases (1–3). Venous bypass, previously the only option for symptomatic PTS, is challenging and has a relatively low graft patency (4). Some authors have reported favorable results in treating chronic total occlusion (CTO) of the iliofemoral vein with endovascular therapy from the midthigh femoral vein or internal jugular vein access (5–7). However, the effectiveness of transpopliteal access for recanalization, as well as the reasons for early in-stent thrombosis and restenosis, is unknown. In 2002, endovascular treatment for postthrombotic CTO of the iliofemoral vein was implemented at our institution, and this alternative approach has gradually become the first-

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choice treatment for these lesions. In this article, we report our experience with stent placement from the ipsilateral popliteal access for managing CTO of the iliofemoral vein, including clinical characteristics, technical details, clinical effects, early stent patency, and complications. We also analyze the risk factors of early in-stent thrombosis and restenosis.

MATERIALS AND METHODS

Patient Selection

This retrospective study comprised 110 consecutive patients (44 men) with 118 limbs (102 left limbs), who underwent attempted angioplasty and stent placement for CTO of the iliofemoral vein in a single institution from January 2007–December 2011. All patients provided written informed consent, and the approval of the Ethics Committee of the hospital was obtained. The age range of patients was 32–81 years, with an average age of 51 years. The CEAP (Clinical-Etiology-Anatomy-Pathophysiology) clinical classification of the treated limbs is shown in Table 1. The mean time from acute iliofemoral deep vein thrombosis to the procedure was 8.2 years (range, 1–40 y). Patients with mild PTS, which corresponds to Villalta scores < 10, were treated with conservative therapy, such as compression stockings or venoactive drugs (8). Data on these interventions were retrospectively collected from a dedicated database containing demographics, clinical presentation, classification, Chronic Venous Insufficiency Quality-of-Life Questionnaire, procedure duration, technical success, patency, symptomatic relief, Villalta scores, and interventional complications during follow-up period.

Puncture Process under Road Map (Subtracted Fluoroscopy) Guidance

In an upright standing position, a tourniquet was placed above the ankle to drive the contrast material into the deep venous system. A 22-gauge plastic intravenous cannula was inserted into the dorsal vein of the foot. The patient was asked to lie prone, and the contrast material was injected via the cannula. A road map was performed in the ipsilateral popliteal vein. After the administration of local anesthesia in the popliteal space, an ipsilateral popliteal vein puncture under road map guidance was successfully achieved (Fig 1a).

Table 1. CEAP Clinical Classification before and after Procedure

Classifications	Before Procedure (118 Limbs), No. (%)	After Procedure (105 Limbs), No. (%)
0–1	0 (0%)	19 (18.1%)
2	2 (1.7%)	2 (1.9%)
3	38 (32.2%)	14 (13.3%)
4	30 (25.4%)	27 (25.7%)
5	2 (1.7%)	33 (31.4%)
6	46 (39%)	10 (9.5%)

CEAP = Clinical-Etiology-Anatomy-Pathophysiology.

Stent Placement Procedure

After the ipsilateral popliteal vein puncture was successfully achieved, heparin sodium 80 IU/kg was administered to achieve an activated clotting time of 250–300 seconds in all patients. An anterograde venogram was obtained to define the existing venous anatomic features from the introducer sheath (Radifocus Introducer II; Terumo, Tokyo, Japan) (Fig 1b,c). A straight 0.018-inch hydrophilic guide wire (V-18 Control Wire; Boston Scientific Corporation, Natick, Massachusetts) was directed through the obstruction of the iliofemoral vein under the guidance of a matched multipurpose catheter or angled-tip catheter (MP A1; Cordis Corporation, Miami Lakes, Florida; TrailBlazer; ev3 Endovascular, Inc, Plymouth, Minnesota). Passage of the guide wire away from the expected direction of the iliofemoral vein with sudden ease denoted venous perforation (5), which was easily recognized by fluoroscopic projection. The guide wire could be withdrawn and redirected under the guidance of an angled-tip catheter. A 6-F, 55-cm Flexor Raabe Guiding Sheath (Cook, Inc, Bloomington, Indiana) placed in the ostium of the occluded iliofemoral vein expedited advancement through the lesions. The guide wire was removed after the catheter was advanced through the lesion. Venography was performed to ensure that the catheter tip was located within the lumen of the inferior vena cava (Fig 1d).

A balloon catheter (EverCross; ev3 Endovascular, Inc; ReeKross; ClearStream Technologies, Wexford, Ireland; PowerFlex P3; Cordis Corporation) with a diameter of 4–16 mm and a length of 60–220 mm was used for dilation (Fig 1e). After balloon dilation, self-expanding stents (EverFlex; ev3 Endovascular, Inc; LIFESTENT; BARD, Tempe, Arizona; WALLSTENT; Boston Scientific Corporation) with a diameter of 10–16 mm and a length of 60–150 mm were implanted. Two stents were usually required because of the long segment of the occluded lesion. The femoral stent was deployed first, followed by the iliac stent. The femoral stent was deployed in the common femoral vein and below the inguinal ligament if needed. The iliac stent extended approximately 2.0 cm into the inferior vena cava. Coverage of the contralateral iliac vein ostium was avoided. The optimal stent diameters of the common femoral vein and iliac vein of most patients ranged from 10–12 mm (common femoral vein) and from 12–16 mm (iliac vein).

The WALLSTENT delivery catheter sometimes was not long enough for the deployment of the stent into the inferior vena cava from the sheath of the ipsilateral popliteal vein. The entire delivery catheter was advanced further cephalad after partial unsheathing of the