CLINICAL STUDY

# Technique and Clinical Outcomes of Combined Stent Placement for Postthrombotic Chronic Total Occlusions of the Iliofemoral Veins

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## ABSTRACT

**Purpose:** To evaluate the technical aspects and early clinical results of combined stent placement for the management of postthrombotic syndrome (PTS) in chronic total occlusions (CTOs) of the iliofemoral veins.

**Materials and Methods:** A total of 81 consecutive patients (mean age, 57 y; 37 men; 81 limbs; 65 left limbs) with postthrombotic CTO of the iliofemoral veins treated with combined stent placement in a single institution from January 2013 to December 2014 were retrospectively analyzed. Wallstents were used for femoral inflow and E-Luminexx stents for iliac outflow. Technical aspects, quality of life (QOL), stent patency, and Villalta scores were recorded at follow-up. Primary, primary assisted, and secondary patency rates were estimated with Kaplan–Meier methods with the log-rank test.

**Results:** Percutaneous recanalization was successful in 77 of 81 limbs (95.1%). Stents were deployed in all iliofemoral occlusions, with two stents in 63 lesions (77.8%) lesions and three stents in 18 lesions (22.2%). Venous perforation occurred in 32 patients (37.4%) and was resolved in all cases after stent placement. Back pain occurred during balloon angioplasty (93.8%) and persisted after stent placement in 56.8% of patients. However, the symptoms were self-limiting without further therapy. QOL and Villalta scores were significantly improved during a median follow-up of 19 months (range, 1–38 mo; $P < .01$). The 2-year primary, primary assisted, and secondary cumulative stent patency rates were 81.5%, 91.4%, and 93.8%, respectively.

**Conclusions:** Combined stent placement is an effective, safe, and feasible method of management of PTS in iliofemoral CTO until commercial venous stents designed for PTS become available.

## ABBREVIATIONS

CTO = chronic total occlusion, DVT = deep vein thrombosis, IVC = inferior vena cava, PTA = percutaneous transluminal angioplasty, PTS = postthrombotic syndrome, QOL = quality of life

Approximately 20%–50% of cases of deep vein thrombosis (DVT) will develop into postthrombotic syndrome (PTS) despite adequate anticoagulation (1,2). PTS carries significant negative impacts on quality of life (QOL), which may require intensive medical care (3,4). Small lumens, fibrosis of the vessel wall, and/or external compression are characteristics of postthrombotic veins. Several studies have suggested that residual venous obstruction plays an important role in PTS development (5,6).

Endovascular recanalization of PTS has gradually become a favored treatment option for PTS in recent years (5–11). Metal stents with good flexibility to cross the inguinal ligament, such as the Wallstent (Boston Scientific, Natick, Massachusetts), are frequently used in PTS (12–14). However, this stent might not be a good choice for the common iliac vein because of its poor radial force and positioning qualities. Stents with greater

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radial resistive force and less foreshortening and associated migration may be more appropriate. For example, the dimensions of an E-Luminexx stent (Bard Peripheral Vascular, Tempe, Arizona) are large enough for deployment in the iliac veins (15). Therefore, a combination of two stents might be suitable for the pathologic characteristics of iliofemoral PTS.

The present study retrospectively assessed our early clinical experience with combined stent placement (Wallstent for femoral inflow and E-Luminexx stent for iliac outflow) in treating iliofemoral CTO causing PTS.

## MATERIALS AND METHODS

### Patient Selection

All patients with chronic venous insufficiency underwent duplex ultrasound (US) and ascending phlebography (injection of contrast medium into a dorsal foot vein) in a single center. Contrast-enhanced computed tomographic (CT) venography was adopted when the iliac confluence could not be visualized on duplex US and ascending phlebography to assess the inferior vena cava (IVC) and iliac veins (Fig 1A1–A3). The "choke point" where the iliac vein was compressed by overlying arterial structures was detectable on CT venography. Characteristics of deep venous obstruction were the absence of the vein and the presence of significant pelvic or femoral collateral vessels.

All patients included in the study experienced PTS with chronic iliofemoral obstruction and moderate/severe symptoms (Villalta score $\geq$ 10) and had undergone failed treatment with venoactive drugs and/or compression stockings. Exclusion criteria included previous DVT surgery or endovascular treatment, DVT history of less than 2 years, mild symptoms (Villalta score $<$ 10), occlusion involving the mid- to distal femoral vein and/or popliteal vein, IVC PTS, and bilateral iliofemoral PTS. All operations were performed by the same team.

The present retrospective study analyzed 81 consecutive patients (37 men) with 81 limbs (65 left limbs) that

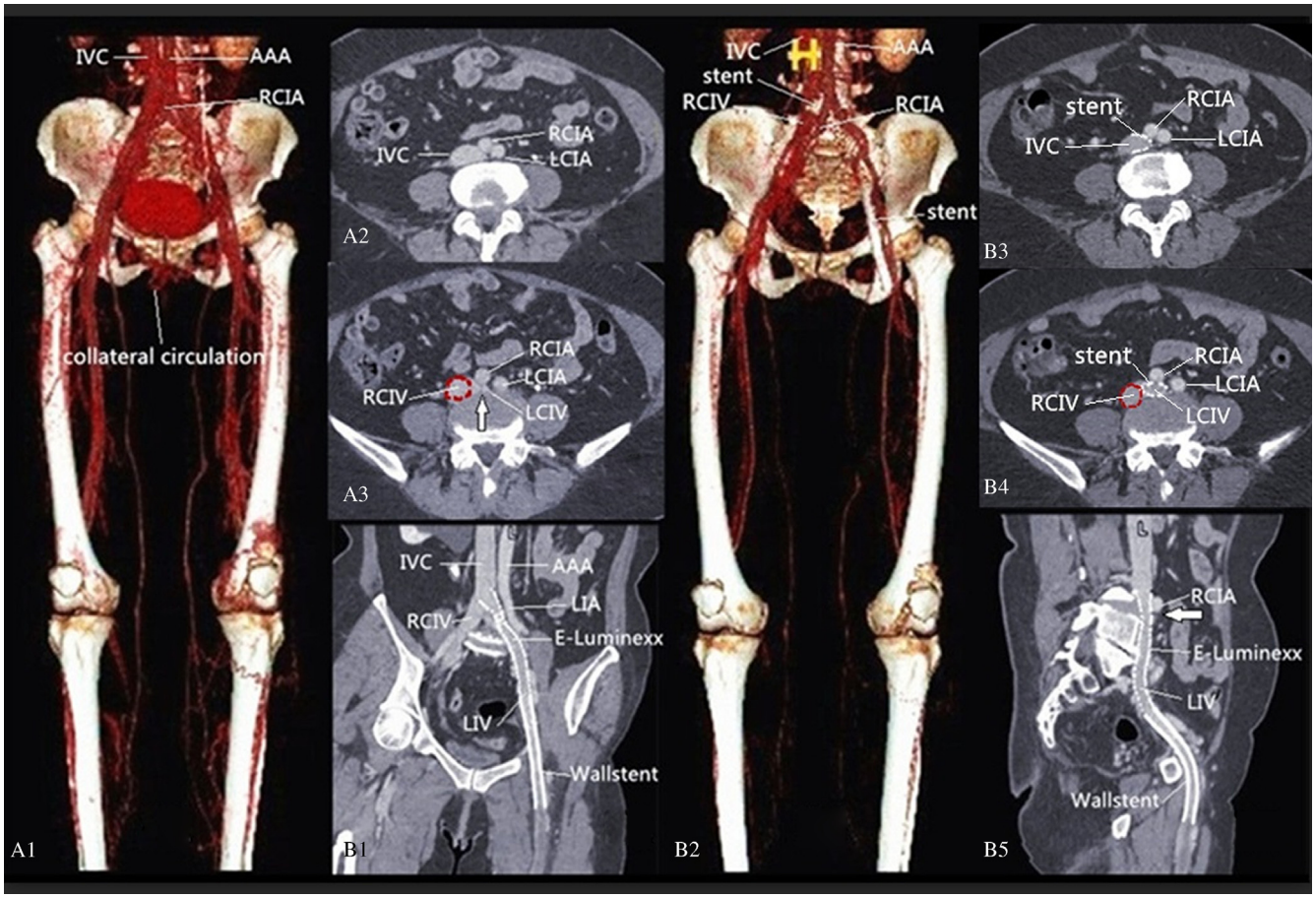


**Figure 1.** Images from a 60-year-old woman with a history of DVT 17 years earlier in whom severe venous claudication and swelling developed in the left lower extremity. (**A1–A3**) CT venography before the intervention shows the presence of significant pelvic collateral vessels that were detected where the left common iliac vein (*LCIV*) was compressed by the overlying right common iliac artery (*RCIA*; **A3**, arrow). **(B1–B5)** CT venography after combined stent placement for iliofemoral PTS. Coverage of the contralateral iliac vein ostium was avoided **(B1,B2)**. The radial force **(B4)** and precise positioning quality **(B1–B3)** of the E-Luminexx stent and the flexibility of the Wallstent **(B5)** are well demonstrated. AAA = abdominal aorta; LCIA = left common iliac artery; LIV = left iliac vein; RCIV = right common iliac vein.