Venovo Venous Stent Treatment for a Special Type of May-thurner Syndrome with Deep Vein Thrombosis: a Case Report

Zhicheng Zhang, Weiquan Zhong, Wenhe Long, Quan Chen*

Department of Oncology Intervention and Vascular Surgery, The Tenth Affiliated Hospital of Southern Medical University, Dongguan People's Hospital, Dongguan, Guangdong, China

*Corresponding author: Quan CHEN, E-mail: 13919093907@126.com

Abstract: Iliac vein compression syndrome (IVCS) typically involves the compression of the left common iliac vein (LCIV) by the right common iliac artery (RCIA). This study presents a unique variant of IVCS where the right external iliac vein traversed between the right internal and external iliac arteries, leading to compression by these arteries. An 83-year-old male was hospitalized due to one week of swelling and pain in his right lower limb, which had worsened over the past day. Computed tomography (CT) revealed thrombosis in the right external iliac vein, right femoral vein, and right great saphenous vein, along with local compression and flattening of the right external iliac vein. After deploying a retrievable inferior vena cava filter via the left femoral vein, the patient underwent intravenous thrombolysis, thrombus aspiration, and received a Venovo vascular stent via the right femoral vein. Post-surgery, the venous blood flow in the right lower limb was restored. The swelling had significantly reduced, and the skin tension had decreased compared to preoperative levels. Our experience suggests that the Venovo stent is effective in managing unique forms of iliac vein compression, yielding favorable therapeutic outcomes and offering a novel avenue for treating specific IVCS presentations in clinical practice.

***Keywords*:** venous stent, may-thurner syndrome, deep vein thrombosis

1. Introduction

Iliac vein compression syndrome (IVCS), also referred to as May-Thurner syndrome [1-2] or Cockett syndrome [3], is a disorder characterized by lower limb and pelvic venous reflux resulting from compression of the iliac vein. This compression not only leads to venous reflux obstruction and lower limb venous hypertension but also serves as a contributing factor to lower limb venous valve dysfunction, superficial varicose veins, and a potential risk factor for secondary deep vein thrombosis.

Based on anatomical variations and CT findings, researchers have categorized iliac vein compression into four distinct types [4]. Type I involves single compression of the left common iliac vein (LCIV), such as compression solely by the right common iliac artery (RCIA). Type II entails double compression of the LCIV, for instance, simultaneous compression by both the RCIA and left internal iliac artery. Type III manifests as simultaneous compression of the LCIV and right common iliac vein (RCIV), leading to luminal narrowing. For example, the LCIV may be compressed by the left common iliac artery (LCIA) while the RCIV is compressed by the RCIA. Type IV encompasses various other forms of venous compression, such as compression of the left external iliac vein by the LCIA.

Here, we present a complex and uncommon case of a unique Type IV iliac vein compression. Utilizing a Venovo vascular stent to restore vascular lumen size has shown to yield significant therapeutic benefits for patients. Our clinical experience in this treatment approach may offer valuable insights for managing special types of IVCS.

2. Case Presentation

The 83-year-old male patient was admitted to our hospital on February 14, 2024, after experiencing a week of swelling and pain in his right lower limb, with the pain worsening over the last day. On February 7, 2024, he suddenly developed swelling and pain in the right lower limb without an apparent cause, along with symptoms like dizziness, fatigue, facial edema, fever, cold sensitivity, chest tightness, chest pain, shortness of breath, and cough. Despite these symptoms, he did not seek medical attention that day. By February 13, 2024, the swelling and pain in the right lower limb had intensified, with a noticeable rise in skin temperature. Seeking further treatment, the patient presented to our hospital. Physical examination revealed significant swelling in the right lower limb compared to the left, elevated skin temperature, and diminished arterial pulsation in the right foot. However, no visible signs of superficial venous tortuosity, pigmentation, pallor, bruising, or ulcers were observed on the skin surface.

The patient, with a history of arrhythmia and paroxysmal atrial fibrillation, has been admitted multiple times to our hospital for treatment. They previously received anticoagulant therapy with warfarin and rivaroxaban but have not been taking anticoagulants recently. Additionally, the patient has a longstanding history of hypertension, with a maximum systolic blood pressure of 170mmHg. They sporadically use amlodipine besylate to manage blood pressure and do not undergo regular blood pressure monitoring. Combining the patient's medical history, clinical symptoms, and physical examination, we preliminarily diagnosed "deep vein thrombosis in the right lower limb" and admitted them to the hospital. Following admission, a comprehensive ultrasound examination of the lower limb blood vessels revealed thrombosis in the right common femoral vein, superficial femoral vein, popliteal vein, and posterior tibial vein (complete type) (Figure 1).

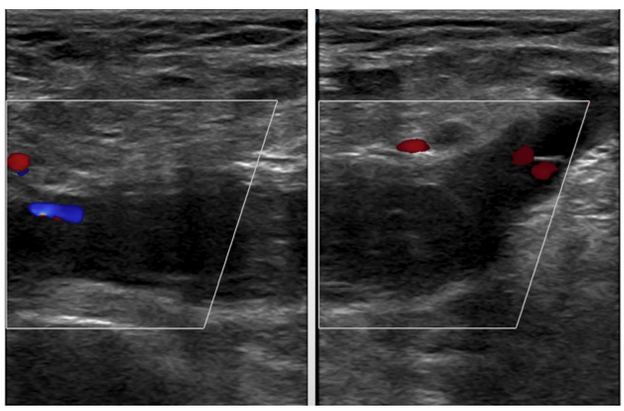

Figure 1. Lower limb vascular Doppler ultrasound: The blood flow in the right lower limb shows a thin line, intermittent short rod shaped blood flow signal, and no obvious blood flow signal is observed in some lumens.

The CT scan results of the inferior vena cava (including bilateral iliac veins) indicated low-density filling defects in the right external iliac vein, right femoral vein, and right great saphenous vein, with blurred and increased density of surrounding fat spaces. While the right common iliac vein and right internal iliac vein remained well filled, the inferior vena cava and left iliac vein showed no obvious signs of filling defects. Considering the thrombosis formation in the right external iliac vein, as well as the right femoral vein and right great saphenous vein, the right external iliac vein appeared locally flattened (Figure 2).

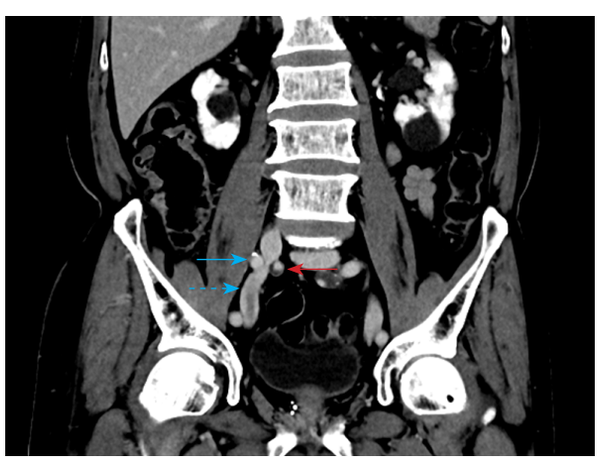

Figure 2. Computerized tomography venography: RCIV is compressed at the intersection between the REIA and the bifurcation of the RIIA.

RCIV: right common iliac vein (blue intermittent arrow)

RIIA: right internal iliac artery (red solid arrow)

REIA: right external iliac artery (blue solid arrow)

Supplementary tests revealed the following results: Coagulation function showed D-dimer quantification (D-Dimer) of >20ug/mL and fibrinogen degradation product determination (FDP) of 111.74ug/mL; Renal function indicated urea (Urea) at 11.7mmol/L, creatinine (Cr) at 152.1umol/L, and uric acid (UA) at 516.3umol/L; Infection indicators displayed Hypersensitivity C-reactive protein (hsCRP) levels above 5.0mg/L and conventional C-reactive protein (rt CRP) at 10.40mg/L; Blood routine tests showed Hemoglobin (HGB) at 125.00 g/L and total platelet count (PLT) at 126.00 * 10^9/L. The patient's liver function, myocardial biomarker examination, B-type natriuretic peptide, procalcitonin detection, and

other test results revealed no significant abnormalities.

After ruling out surgical contraindications, on February 19, 2024, we proceeded with the placement of an inferior vena cava filter, right lower limb venous thrombolysis and thrombus aspiration, right iliac vein balloon catheter dilation, and stent implantation under local anesthesia. A left dorsalis pedis venous angiography was performed, and the right anterior tibial vein was punctured to insert a 6F vascular sheath. Local anesthesia with lidocaine was administered 2cm below the inner side of the pulsation point of the left inguinal femoral artery, with an incision size of approximately 0.3cm. Following successful femoral vein puncture using the Seldinger method under local anesthesia, a 6F catheter sheath was introduced. Subsequent catheter sheath angiography revealed unobstructed left iliac vein and inferior vena cava without any signs of thrombosis. Using the left iliac vein approach, a 5F Cobra catheter was inserted for bilateral renal vein angiography. The guide wire was retained in the inferior vena cava, the filter delivery system was replaced, and one recyclable filter was released below the bilateral renal veins. Post-insertion, the filter was confirmed to be well unfolded and not tilted, allowing smooth flow of contrast agent through the filter cavity (Figure 3).

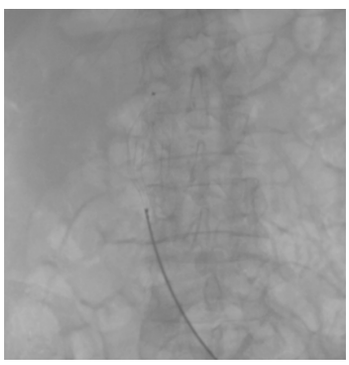

Figure 3. Implantation of a "cage shaped" retrievable inferior vena cava filter through the left femoral vein.

Following the placement of the inferior vena cava filter, we proceeded to insert a 4F ultra-smooth single curved catheter through the right anterior tibial vein, along with a loach guide wire, navigating into the inferior vena cava through the thrombus occlusion segment (Figure 4). Once the imaging was clear, we swapped the long hard loach guide wire and directed it to the thrombus removal device to dissolve and aspirate the thrombus from the right iliac vein. Subsequent angiography revealed a significant reduction in thrombus compared to the initial presentation. However, there were still two noticeable signs of compression in the local area of the right iliac vein. Following the successful femoral vein puncture using the Seldinger method, we replaced the 8F vascular sheath.

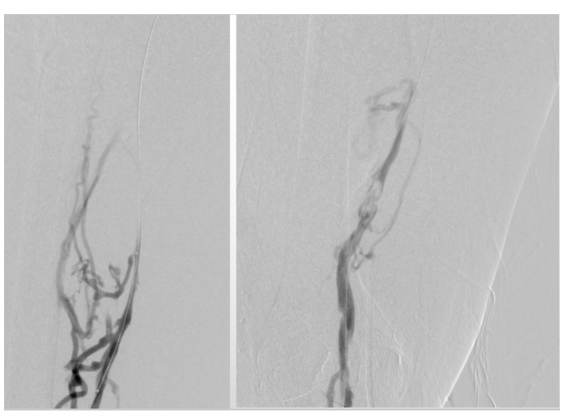

Figure 4. Digital subtraction angiography shows thrombus formation in the right superficial femoral vein, with collateral vessel enhancement.

Initially, we utilized a Baiduoli Passeo balloon for predilation, with a diameter of 6mm and a length of 12cm, followed by the placement of a Budd iliac femoral vein stent measuring 12mm in diameter and 10cm in length within the lesion segment (Figure 5). Post-stent implantation, a Budd balloon with a diameter of 12mm and a length of 4cm was employed for further dilation. Subsequently, a 10mm diameter and 6cm length balloon were used to dilate the narrow segment of the right femoral vein. Through the right anterior tibial vein approach, angiography demonstrated unobstructed blood flow in the right popliteal, superficial femoral, iliac, and inferior vena cava, with minor wall filling defects observed locally (Figure 6). The thrombus clearance was deemed satisfactory. Following thrombus removal, we retrieved the filter via the left femoral vein

approach. Post-filter removal, angiography through the left femoral vein approach revealed unimpeded blood flow in the left iliac vein, with no evident filling defects or contrast agent retention.

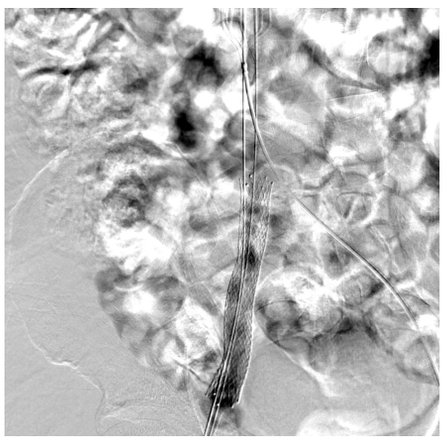

Figure 5. After implantation of the Venovo stent into the iliac vein, the blood flow inside the stent is smooth.

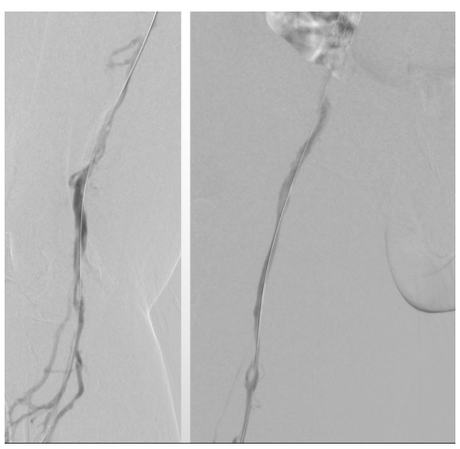

Figure 6. Postoperative superficial femoral vein angiography showed unobstructed blood flow and significantly reduced collateral vessel imaging.

Following the procedure, we initiated anticoagulation therapy using low molecular weight heparin (0.6ml H q12h). Upon discharge, the patient transitioned to oral anticoagulant medication rivaroxaban (15mg po bid), with a recommendation to continue anticoagulant treatment for 3-6 months. Three weeks post-discharge, the patient returned for a follow-up examination, reporting no recurrence of lower limb edema or pain symptoms. Doppler ultrasound results of the lower limb veins confirmed the absence of significant abnormalities, with unimpeded blood flow observed in the deep vein of the right lower limb (Figure 7).

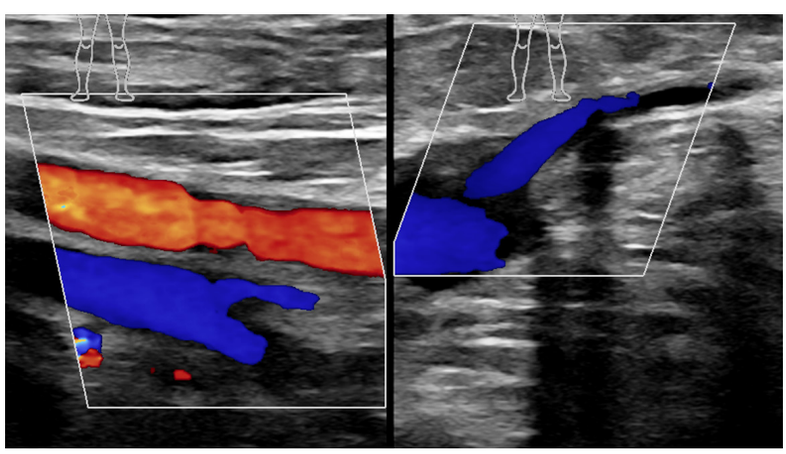

Figure 7. Three weeks after surgery, the patient's follow-up ultrasound showed unobstructed deep venous blood flow in the right lower limb.

3. Discussion

Due to congenital anatomical variations, the majority of patients with iliac vein compression may not present with overt clinical manifestations; however, approximately 2-5% of individuals may exhibit acute or chronic symptoms like lower limb edema, pain, and skin discoloration. Hence, the diagnosis of May-Thurner syndrome (MTS) patients necessitates a keen clinical acumen and a high index of suspicion, alongside the utilization of diagnostic modalities such as intravenous ultrasound, computed tomography venography (CTV), and magnetic resonance venography (MRV) for timely evaluation.

The inferior vena cava (IVC) is situated to the right of the abdominal aorta, dividing into LCIV and RCIV at the anterior aspect of the 5th lumbar vertebra. IVCS arises predominantly from the compression of LCIV between RCIA and the vertebral body, disrupting LCIV blood flow and fostering the development of deep vein thrombosis (DVT) in the lower limbs. Consequently, IVCS commonly manifests in the left lower limb[5], while occurrences of right iliac vein compression syndrome (RIVCS) are exceedingly rare. Currently, only two multicase studies on RIVCS[6-7] and three case reports[8-10] have been identified.

In a retrospective analysis by Chen et al.[6], 16 cases of non-thrombotic RIVCS patients were examined. Based on CT findings, RIVCS was categorized into three types. Type I involves compression of the right common iliac vein by the right common iliac artery and lumbar spine; Type II entails compression at the juncture of the right external iliac artery and the bifurcation of the internal iliac artery; Type III is solely compressed by the right external iliac artery. According to this classification, the current case aligns with Type II.

Nevertheless, there is presently no definitive guideline for diagnosing and managing May-Thurner syndrome. Following the European Society for Vascular Surgeries (ESVS) recommendation: in cases where patients exhibit severe symptoms and signs of iliac vein outflow tract obstruction, endovascular intervention is suggested as the preferred course of action (IIa B) . Research findings by Chen et al. [7] demonstrated that 15 RIVCS patients experienced notable symptom relief post stent implantation, with subsequent CT scans confirming unimpeded stent blood flow. Additionally, Sang et al. [11] propose that stent implantation is warranted when stenosis exceeds 70%, and for stenosis ranging between 50% and 70%, decisions should be tailored to the individual's circumstances. In the presented case, the RCIV stenosis exceeded 70% with evident clinical symptoms tied to RCIV. Consequently, with the patient's consent, prompt endovascular intervention was performed, yielding favorable clinical outcomes.

4. Conclusion

In conclusion, we advocate that endovascular therapy stands as the optimal approach for addressing May-Thurner syndrome, encompassing mechanical thrombus aspiration, IVC filters, balloon angioplasty, and stent placement. Compared to conventional surgical methods, interventional procedures offer the benefits of reduced invasiveness, lower risks, and diminished recurrence rates. The amalgamation of balloon dilation and stent implantation emerges as an efficacious strategy for managing iliac vein stenosis.

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