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Case Report

Reconstruction of an inferior vena cava stent occlusion using double-barrel stenting in a patient with Behçet's disease

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ABSTRACT

Symptomatic inferior vena cava (IVC) and iliac vein thrombosis is increasingly being treated with thrombolysis, thrombus retrieval and deep venous stenting. If the IVC stent occludes, endovenous intervention is indicated to restore patency. An 18-year-old male with Behçet's disease presented with deep vein thrombosis (extending from the IVC to the popliteal segments bilaterally) which was initially treated with thrombolysis and stenting. Fifteen months later, the patient experienced symptomatic deterioration; a chronically-occluded IVC stent was identified and reconstructed using a double-barrel stenting technique. Patient compliance to post-stenting anticoagulation therapy is paramount to maintain stent patency. A multi-disciplinary approach including haematologists can be beneficial for patients with a background of thrombophilic disorders.

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Introduction

Deep venous disease can occur from the inferior vena cava (IVC) to the calf veins. IVC disease is uncommon and associated with high morbidity [1]. If untreated, the patient can develop lower extremity pain, swelling and venous ulceration [1].

Treatment of IVC disease involves medical management (anticoagulation) and/or endovenous intervention (thrombolysis,

and often venoplasty with stenting) [1]. Endovenous intervention results in favorable long-term patency and safety outcomes [2]. Reintervention is indicated when stent occlusion causes symptomatic deterioration [3]. The purpose of reintervention is to achieve stent patency and symptom relief [3].

Acute stent thrombosis can be treated relatively easily with thrombolysis, whereas a chronic fibrosed occlusion is more challenging. This report describes a novel approach to treating a chronically occluded IVC stent using a double-barrel approach.

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Fig. 1 – Occluded right iliac vein with presence of venous collaterals (white arrow). Sinus-XL stent within the IVC is also demonstrated (black arrow)

Case report

Background

A male of south-Asian descent with Behçet's disease initially presented at the age of 18 years with a 3-week history of back and left leg pain. Duplex sonography revealed an acute left iliofemoral DVT.

Computerized tomography (CT) venography demonstrated thrombus extending from the distal intrahepatic IVC to the popliteal veins bilaterally. The patient received catheter-directed thrombolysis (CDT) and subsequently the infrarenal IVC segment was stented using a 20mm x 100mm sinus-XL stent (OptiMed, Ettlingen, Germany). The patient's swelling and discomfort resolved. Anticoagulation with warfarin was commenced (INR range: 2-3).

Fifteen months after the initial IVC stenting (now aged 20 years) he presented with a 3-day history of right leg discomfort and swelling. His INR (1.8) was subtherapeutic. Duplex sonography of the right leg identified acute thrombus in the right common iliac vein (CIV) and right external iliac vein (EIV). Additionally, CT venography identified a chronically occluded IVC sinus-XL stent.

The patient selected endovenous intervention (thrombolysis of the acute iliac disease, endovenous recanalization of the chronically occluded IVC and further stenting) and the initial venogram (Fig. 1) confirmed the CT findings.

Crossing the occluded iliac veins, inferior vena cava and inferior vena cava stent

CDT was commenced but it was recognized that thrombolysis alone was insufficient to recanalize the occluded IVC stent. Access was achieved from the right proximal superficial femoral vein. Progress could only be made as far as the proximal right CIV despite using a combination of wires and catheters. A 5F Fountain (Merit Medical Systems, Utah, USA) with a 30 cm infusion segment was positioned in the distal

Table 1 – Wires and catheters used to traverse the occluded CIV and inferior vena cava lesion.

Wires

0.035" Stiff-angled GLIDEWIRE (Terumo, Tokyo, Japan)
0.035" Standard Terumo GLIDEWIRE (Terumo, Tokyo, Japan)
0.035" Stiff-straight Terumo GLIDEWIRE (Terumo, Tokyo, Japan)
0.035" Terumo GLIDEWIRE ADVANTAGE (Terumo, Tokyo, Japan)
0.035" Amplatz Super Stiff (Boston Scientific, Marlborough, Massachusetts, USA)
0.018" V-18 ControlWire (Boston Scientific, Marlborough, Massachusetts, USA)
0.018" Hi-Torque Command (Abbott, Chicago, Illinois, USA)
Catheters
5F IMPRESS Cobra 2 (Merit Medical Systems, South Jordan, Utah, USA)
5F IMPRESS Berenstein (Merit Medical Systems, South Jordan, Utah, USA)
5F IMPRESS Multipurpose (Merit Medical Systems, South Jordan, Utah, USA)
Straight GLIDECATH (Terumo, Tokyo, Japan)
NAVICROSS Support Catheter (Terumo, Tokyo, Japan)

CIV and a 5mg bolus of tissue plasminogen activator (tPA) (Actilyse, Boehringer Ingelheim, Ingelheim am Rhein, Germany) was administered. Thereafter, tPA was infused via the catheter (0.5mg per hour) and unfractionated heparin (400iu per hour) through the sheath.

Twenty-four hours later (day 1), a catheter venogram was performed. Further attempts were made to cross the occluded proximal CIV and IVC stent. Using a variety of wires and catheters (Table 1), the chronically occluded IVC was crossed, however, for a short segment the catheter exited the stent to lie against the vessel wall. A similar Fountain catheter was positioned in the proximal iliac stent. tPA and heparin infusion was continued.

A further 24 hours later (day 2), the IVC stent remained occluded highlighting the chronic nature of the disease. A combination of wires and catheters were employed to achieve intraluminal access throughout the lumen of the stent. Due to persistence of right iliac vein thrombus, thrombolysis was continued for a further 24 hours.

Upon completion of 72 hours of thrombolysis (day 3), a decision was made to recanalize and stent the ilio caval disease.

Endovascular inferior vena cava reconstruction

Left femoral vein access was achieved to complement the established right-sided access. Venography demonstrated a patent suprarenal IVC, however the distal (stented) portion of this segment was stenosed. A small channel was developed through the lumen of the chronically occluded sinus-XL stent. The right CIV and EIV were heavily stenosed, whilst the left CIV was patent but also stenosed. Sequential venoplasty of the occluded sinus-XL stent and diseased suprarenal IVC was performed using a 16mm x 40 mm (18 atm) Atlas balloon (Bard Peripheral Vascular, Temple, Arizona, USA), then simultaneously (from each leg) using two 12 mm x 40mm (14 atm) Mustang balloons (Boston Scientific, Marlborough, Massachusetts,



Fig. 2 – Inferior vena cava in-stent stenosis

USA). Finally, two 14 mm x 40 mm (18 atm) Atlas balloons were used to recanalize the chronically occluded sinus-XL stent. Each diseased iliac segment was also predilated with a 14 mm x 40mm (18 atm) Atlas balloon (Fig. 2).

Venography was performed to identify the landing zone within the IVC, left and right EIVs. Two 14mm x 120 mm Vici Venous Stents (Boston Scientific, Marlborough, Massachusetts, USA) were deployed proximally in a double-barrel formation, extending from the suprarenal IVC to the recanalized sinus-XL stent. Each of these were extended with a further 14 mm x 120 mm Vici Venous Stent (2 cm overlap) into the corresponding CIV. On the right side, a further 14mm x 90mm Vici Venous Stent was required to treat the diseased distal CIV and proximal EIV (Fig. 3).

Post-dilation of the stented segments was completed with a 14 mm x 40mm (18 atm) Atlas balloon (simultaneously in the double-barrel section). Completion venography confirmed stent patency, proximal outflow, and the absence collateral flow (Fig. 3).

Post-operative recovery and surveillance

Duplex sonography at day 1 confirmed stent patency. The patient was discharged on a therapeutic regimen of enoxaparin (12-hourly 1mg/kg subcutaneously) and thigh-length class II graduated compression hosiery. A further 2-week, 6-week, 6 month and thereafter annual surveillance programme was planned. Arrangements were made to transition him onto warfarin (INR range 2-3) at 6 weeks post-intervention.

Stent reocclusion

One week prior to his 6-month surveillance scan, the patient reported right leg swelling and discomfort. There were issues with anticoagulation compliance (INR 1.7). Duplex sonography and CT venography confirmed acute thrombotic occlusion of the stented ilio caval segments. As the occlusion was

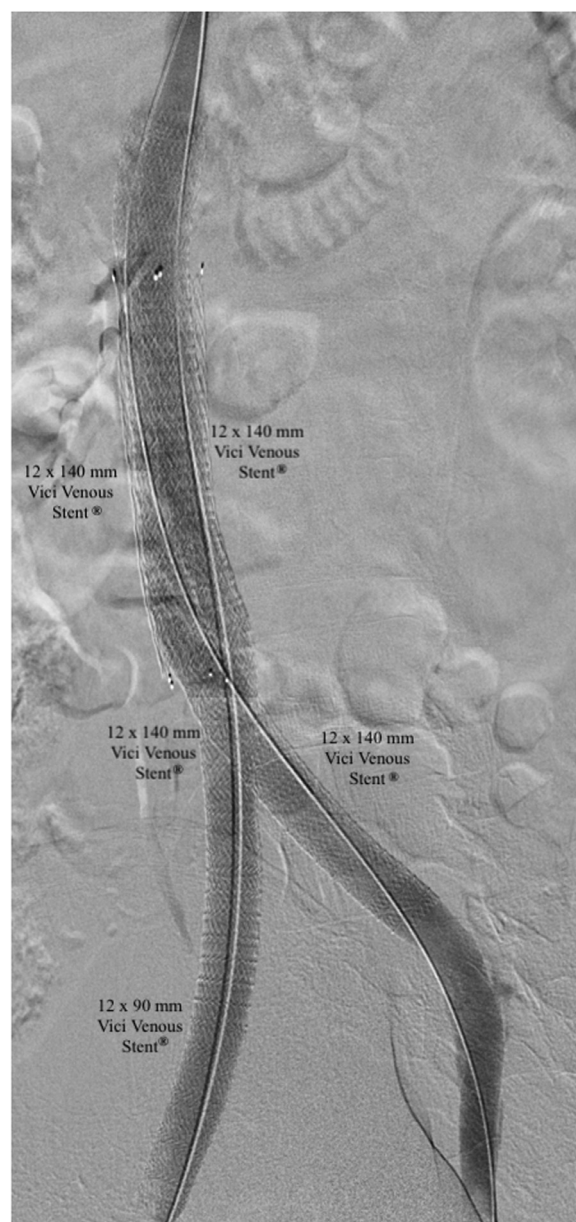


Fig. 3 – Successful deployment of the stents in a double-barrel configuration

due to an acute thrombus (rather than the previous chronic disease) the entire segment could be treated with thrombolysis alone. Thrombolysis was commenced for 72 hours, with check venography at 24-hour intervals. The acute nature of the disease allowed easier crossing of the stents. Venoplasty was performed with 14mm x 40 mm (18 atm) Atlas balloons.

He was continued on a further 6 weeks of therapeutic enoxaparin (12-hourly 1mg/kg subcutaneously) and then transitioned onto warfarin. The venous duplex surveillance plan (as described previously) was recommenced.

A year since his most recent intervention, surveillance duplex scans demonstrate patent stents with no stenosis or compression (Fig. 4).

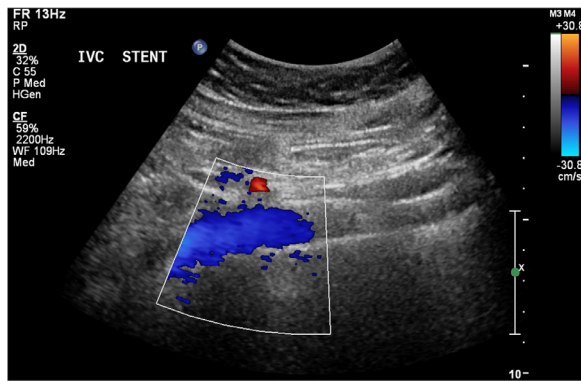


Fig. 4 – Surveillance duplex sonography demonstrating wall-to-wall color filling and good patency of the double-barrel stents at 1-year post-intervention

Discussion

Deep venous disease can result in debilitating symptoms [4]. As younger patients are more commonly affected, there is a substantial economic burden, with up to 4.6 million work days lost annually [5].

Traditionally, deep venous disease has been medically managed (compression therapy and anticoagulation). Endovenous intervention has become increasingly prevalent; predominantly with thrombolysis followed by venoplasty and stenting if necessary [4].

Initially, endovenous stenting was performed using arterial stents such as the Wallstent (Boston Scientific, USA). However, to accommodate for the different characteristics of the venous system, dedicated stents of various designs (open-cell, closed-cell, hybrid) have been developed. The current 1-year patency data suggests that primary patency ranges from 59% to 94% [6]. It is envisaged that over time, the development of second-generation dedicated venous stents, accrual of experience in venous stenting and robust post-stenting protocols will improve long-term patency.

Double-barrel stenting for acute and chronic native IVC disease has been described previously [2]. Recanalization (using thrombolysis, venoplasty and stenting) of acutely occluded stents at the ilio caval confluence has also been reported [7], however the reconstruction of a chronically occluded IVC stent with a double-barrel stent configuration (as in this case) has not been described.

Intervention within the IVC presents unique challenges that are disparate from the iliac region such as the wide calibre of the vessel. In such instances, restenting with a single larger calibre IVC stent (eg, > 16 mm diameter) that has lower radial resistive force increases the susceptibility to further stent compression [8]. Adopting a double-barrel configuration mitigates this risk as the smaller diameter stents exert greater resistance against external compression thus ensuring that patency is more likely to be maintained [9].

As identified in this case, in-stent thrombosis that remains untreated can become sclerotic and difficult to traverse [3]. Over time, in-stent lesions can become heavily calcified,

and unamenable to venoplasty. There is limited literature on the histopathology of in-stent thrombotic lesions. Robertson et al.[10] note that the histological architecture of occluded stents consist of smooth muscle, stellate cells and spindle cells embedded in proteoglycan extracellular matrix. Greater investigation of the histopathology of in-stent thrombotic lesions is required.

In this report, the patient had poor adherence to post-stenting anticoagulation which may have contributed to the reocclusion of his IVC stent. Compression hosiery alongside anticoagulant therapy remains the mainstay of long-term post-stenting medical management to minimize the risk of recurrent deep vein or in-stent thrombosis, and prevent post-thrombotic syndrome [1]. To optimize post-stenting medical management and promote compliance, patient education alongside a multi-disciplinary approach (including a hematologist) may be beneficial.

Conclusion

This case demonstrates a novel approach to reconstructing a chronically occluded IVC stent. Patient compliance to post-stenting medical therapy is paramount in order to maintain stent patency. In patients presenting with thrombophilia disorders, a multi-disciplinary approach including hematologists can be beneficial.

Patient Consent

The patient's consent was obtained for this case report.

Declaration of Competing Interest

The authors report no conflict of interests.

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