

# What's New and What's Needed in Chronic Venous Occlusion Therapy

CVO expert Lawrence “Rusty” Hofmann, MD, shares his view of the landscape, plus his crossing techniques and device preferences.



## How is chronic venous occlusion (CVO) typically diagnosed?

CVOs have historically been diagnosed using ultrasound while evaluating occlusions in the infrainguinal area. However, a large segment of patients with chronic venous disease

has been overlooked and neglected for many years because practitioners—primarily primary care doctors and at times, even vascular specialists—are not looking above the inguinal ligament. For the past 15 years, it has been my practice to use cross-sectional imaging (either CT venography or MR venography) to understand the status of iliac veins and inferior vena cava (IVC). It has been shocking how much disease has been uncovered there, which explains the symptoms the patients have had for many years that have gone undiagnosed or untreated.

## What characteristics of an occlusion dictate how you approach crossing and treatment? In other words, how do you specifically match treatment to lesion/anatomy?

First, I determine whether it is a native venous occlusion or an occluded stent. Our experience at Stanford is approximately a 95% success rate in crossing native venous occlusions regardless of their location. We have been successful in crossing native occlusions that are 25 years old. In recent memory, the only occlusions we have been unsuccessful in crossing are those that had occluded stents placed at outside hospitals, and in these cases, the stents had been occluded for a number of years.

It is difficult to predict which access site will be successful when recanalizing the iliac vein and IVC. For this reason, we make sure we have the right internal

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jugular vein prepped and the right common femoral vein prepped, and/or the popliteal vein prepped (dependent on the anatomy). My preference is to start with the popliteal vein access. We are very comfortable in stenting the IVC, iliac, and femoral veins down to the lesser trochanter. Below the lesser trochanter, our preference is to perform venoplasty. We have had success in recanalizing all of these locations. However, I am apprehensive to reconstruct the iliac system and IVC system via stenting without adequate inflow from the legs. The inflow from the legs can either come from the femoral vein or, more commonly, from the profunda femoral vein, because the femoral vein is occluded. We do have patients who are symptomatic with occlusions of only the femoropopliteal vein with patent veins above the inguinal ligament. In these patients, we will cross and use prolonged angioplasty to restore flow.

## What challenges in crossing these obstructions are unique to the venous setting? In other words, how do chronic venous obstructions differ from arterial chronic total occlusions?

This is a very interesting topic. As the artery begins to occlude, due to positive remodeling, the artery

## FOUR TIPS FOR EFFECTIVE CENTRAL VENOUS OCCLUSION CROSSING

1. Obtain CT venography before the procedure for planning to identify all anatomy and collaterals.
2. Initially, be gentle. I typically start with an angled-tip regular hydrophilic guidewire, and if that's not effective, I move to a stiff hydrophilic guidewire. If that's not effective, I then move to a Roadrunner hydrophilic guidewire (Cook Medical) with a long, tapered tip. With all of these options, I use a torqued device and spin the wire very quickly one way, and if that's not effective, I spin it the other way to see if I can find a tiny foothold and burrow through the occlusion.
3. Column strength is needed to perform a venous recanalization. Using either a guide catheter and hydrophilic catheter combination, or a TriForce set (Cook Medical), will provide the longitudinal column strength in order to bore through the venous occlusions.
4. Don't give up! Venous canalization procedures can take from 2 to 11 hours, depending on the extent of disease. A typical chronic common and external iliac vein occlusion can be completed in 90 to 120 minutes. The case duration gets significantly longer when the IVC is involved and the contralateral leg needs to be crossed as well.

actually enlarges and then completely occludes with atherosclerotic debris. Subsequently, there is actually a lumen that, if successful, you can cannulate, and/or a diseased vessel wall, in which you can perform subintimal dissection and reentry to restore arterial flow. On the venous side, once the vein is occluded, the thrombosis becomes more organized. The endothelial cells in the vein no longer feel the shear stress of the blood flow. Shear stress is a potent mitogen to the endothelial cells. With the lack of signals, these endothelial cells stop mitosis, and then the vein actually involutes. If you look at CVOs on CT venography, the vein is often a tiny wisp—almost the diameter of a couple strands of hair. If that little wisp is there though, you can often stay intraluminal and reenter within the IVC using proper recanalization techniques.

### How would you describe the current data landscape when it comes to CVOs and associated therapies?

The current landscape is dominated by work of Drs. Seshadri Raju and Peter Neglén. They have done a phenomenal job in recording their single-center series. The big question is: how can their success be replicated across the country? Within my practice over the past 15 years and others, we have seen similar success rates; however, our lack of discrete data points and the evolving field of how to quantify the severity of

venous disease have made it challenging to document the outcomes. What I can say is that the hematologists, primary care doctors, and the vascular surgeons who refer patients to me, continue to do so due to the enormous success of the procedure and the gratitude the patients express after the recanalization of these CVOs.

### What data or trials do we currently need?

The work done by Dr. Suresh Vedantham at Washington University with the ATTRACT trial will go a long way toward answering what's needed and addressing the efficacy of endovascular treatment of acute deep vein thrombosis (DVT). We need a similar type of data with chronic DVT. There are two ongoing trials looking at venous stents. As a reminder, there are no FDA-approved venous stents in the United States. The Cook VIVO trial (Cook Medical) includes both acute and chronic patients, and the VIRTUS trial (Veniti) involves only patients with chronic occlusions. Both of these trials enroll patients undergoing stenting of the iliofemoral segment. The data from these two trials will be pivotal in our understanding of the disease. The next frontier will be how to perform interventions in the femoral and popliteal veins with venoplasty and/or stenting. Additionally, an entire body of work needs to be done on the post-stenting patient in regard to

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anticoagulation: Who should be anticoagulated? With what anticoagulant and/or antiplatelet? And, for what duration?

I believe that the anticoagulation strategy is absolutely key to long-term patency in these patients.

### **On the device side, where is the current armamentarium falling short?**

I think we need to find faster ways to recanalize CVOs. Historically, I have used a guide catheter, a hydrophilic catheter, and a hydrophilic guidewire in order to do recanalizations. I have worked with Cook over a number of years to create a kit called TriForce that actually is built on these types of catheters in order to achieve recanalization. Anecdotally, in our practice, we have observed that this setup has allowed crossing of venous occlusions that previously we were unable to cross or has significantly reduced our crossing time by approximately 50% to 80%.

However, it is still very difficult to predict which patients will be long cases versus short cases. The most difficult cases are those in which we have to go extravascular and then reenter the vein. I have used the Outback Re-Entry Catheter (Cordis Corporation) a handful of times, which allowed successful crossing. A similar type of catheter that is larger and uses a 0.035-inch system would be excellent for the venous space. The other big shortcoming on the device side is the radial force of the existing stents. Currently, the stents available in the United States lack sufficient radial force to completely expand after deployment. In our practice, we perform cone-beam CT after stent deployment, and it is not uncommon to see a maximal diameter of even Wallstents (Boston Scientific Corporation) to be 8 mm to 10 mm when in fact they were dilated to 16 mm.

### **What device sizes and characteristics are ideal in this setting?**

Again, I believe devices that are designed to quickly cross the occlusion are needed: low-profile, long (> 20-cm) angioplasty balloons to predilate the lesions (although these are pretty much commercially available already), and longer, stronger stents so that we can reconstruct using three or four stents, rather than seven or eight, for IVC and iliac vein occlusions.

### **What are your preferred imaging modalities in diagnosis planning and treatment?**

My favorite imaging modality for the workup of the patient is CT venography. The high spatial resolution and multiple-plane reconstruction make CT venography excellent in preprocedural planning. I find that having these images up in the room while I am performing the procedure enables me to correlate what I am seeing with the CT venogram and helps me identify the correct channel and location through which to proceed in the recanalization. ■

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