PANEL DISCUSSION

Venous Ulcers With Deep Obstruction and Superficial Reflux: How I Do It

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A patient is referred from a wound clinic with a 15-month history of left leg ulceration. The ulcer is large (50 cm^2), located on the medial aspect of the ankle, and has not been responding well to the wound clinic's treatment using topical wound therapies and compression therapy. They suspect that venous disease is the primary etiology of the wound. What testing protocol do you use to evaluate the venous system for abnormal reflux or obstruction? Do you use duplex ultrasound imaging alone or also obtain axial imaging using CT, MRI, or other?

Dr. van Rijn: I always start with duplex ultrasound, which I perform myself. At our outpatient clinic, all deep venous experts have been trained to perform duplex ultrasound, and we train our residents as well. Performing the duplex investigation myself allows me to really study the venous anatomy in detail and look for possible abnormalities, with specific focus on wounds and other clinical signs and symptoms. I will investigate the leg as well as the abdomen, and after the first visit, I will know this patient's superficial and deep venous status of leg and abdomen with respect to both reflux and obstruction. I will perform additional imaging only when I am considering a deep venous intervention such as an iliac vein stent.

Dr. Toonder: I first exclude possible peripheral artery disease and measure ankle-brachial indices. Then, with the patient in the supine position, I perform extensive duplex ultrasound of the inferior vena cava (IVC) and iliac tract, excluding possible compression and obstruction and identifying venous scarification and intra-abdominal collaterals. In an upright position, I confirm

suspected iliac vein compression and assess venous valvular function of the complete venous system of the legs. If and when there is an intention to treat, in the case of obstructive venous disease, complementary diagnostic imaging is advisable.

Venous ultrasound studies have identified that the patient with left leg ulceration described in the previous question has abnormal reflux in the great saphenous vein (GSV) throughout its length with diameters of 6 to 8 mm in the calf and 8 to 10 mm in the thigh. The deep system in the leg is patent with no evidence of obstruction or reflux. On ultrasound or CT/MRI, there is evidence of compression of the left common iliac vein (CIV) by the right common iliac artery that appears to be between 50% and 70%. What treatment would you recommend for this patient: ablation of the GSV alone, venography/intravascular ultrasound (IVUS) and possible stenting of the CIV, or both? If both, would you stage the procedures or perform them simultaneously?

Dr. Toonder: Compression of 50% to 70% on CT/MRI is a common finding in healthy patients and in and of itself should not be considered as a pathologic finding. I assess suspected CIV compression with ultrasound with the patient in an upright position. The compression will become less significant in the majority of cases. Always assess the flow direction of the ipsilateral internal iliac vein, and pay attention to the presence or absence of pelvic collateral veins. Ablation of the GSV is the primary treatment of choice.

Dr. van Rijn: Considering the diameter of the GSV, the extent of the reflux, and the fact that the patient only has a potentially significant compression of the CIV and not a postthrombotic obstruction, I would start with ablation of the GSV alone and evaluate the effect on the wound closely. I choose this strategy because I believe that the refluxing GSV has a large negative impact on healing of the wound, and I am less sure at this stage about the negative impact from the CIV compression. Also, an iliac vein stent is a more invasive treatment, with a higher complication rate and the need for temporary anticoagulation with additional risks. Even if I consider both treatment options, I would stage the two procedures, starting with the less invasive one.

For a patient with a venous leg ulcer and evidence of ipsilateral nonthrombotic iliac vein compression, how do you determine whether compression of the iliac vein is severe enough to inhibit healing, warranting placement of a stent? Do you go by IVUS-derived diameter reduction, area reduction, presence of collaterals, or other?

Dr. Toonder: First, I assess suspected CIV compression with ultrasound with the patient in an upright position. As previously mentioned, the compression will become less significant in the majority of cases. Assess the flow direction of the ipsilateral internal iliac vein and whether pelvic collateral veins are present or absent. The fact that you can examine the patient in an upright position is the strongest attribute of duplex ultrasound. No other diagnostic tool can provide this vital information to date. IVUS should only be used to identify true venous scarification such as fibrotic wall lesions and intraluminal synechia. Diameter or lumen reduction without evidence of fibrotic venous lesions is an insufficient ground for treatment. Extrinsic compression should be confirmed with a complementary diagnostic tool.

Dr. van Rijn: This can be tricky and difficult to determine. With a patient in supine position, the amount of compression of the CIV can be overestimated, so I always also examine the patient in a half-sitting position, although this makes the duplex investigation more challenging. I look at a combination of things to determine whether the compression is inhibiting ulcer healing. Of course, the amount of compression is one of them, and if this is not > 50%, I don't think a venous stent is indicated. Besides duplex ultrasound, I prefer phlebography with pressure measurements together with IVUS to measure area reduction. On phlebography, you can also see the presence of collaterals, which make a strong case for the significance of the obstruction. I combine this information with other items like: "Are there other possible factors that inhibit ulcer healing (impaired walking, inadequate edema reduction, diabetes mellitus)?" and "Does the patient complain of venous claudication or other symptoms that correspond with venous outflow obstruction?" Based on all of the above, I decide if stent placement is warranted.

A patient is referred with a recalcitrant left leg ulcer that has been present for over a year and is not responding to compression therapy and wound care. The patient has a history of several episodes of deep vein thrombosis (DVT) in the left leg over the last 10 years. Venous studies indicate that there is reflux in the GSV, which measures 3 to 5 mm below the knee and 5 to 7 mm in the thigh. There is evidence of postthrombotic changes in the popliteal and femoral veins, but they are patent with reflux. The left iliac vein appears occluded on pelvic

venous imaging. What treatment would you recommend for this patient: ablation of the GSV alone, stenting of the iliac vein, or both? If you would recommend both, would you stage the procedures or perform them simultaneously?

Dr. van Rijn: In this case, my strategy is less "standard" compared to the previous nonthrombotic iliac vein lesion (NIVL) case, and it is suspected that the negative contribution of the occluded left iliac vein on ulcer healing is much larger than the NIVL. Whether it is larger than the GSV reflux depends on the diameter of the GSV and the extent of the reflux; 5 to 7 mm at the thigh and smaller toward the lower leg is not very large, so in this case, the obstruction might be the most important factor. I like the strategy Raju et al proposed in which they treated patients with a venous leg ulcer according to the following algorithm: (1) incompetent GSV ablation only if the vein diameter was ≥ 5 mm and specific clinical features associated with iliac vein obstruction (significant limb swelling, severe diffuse venous limb pain) were absent; (2) iliac vein stenting plus GSV ablation if the vein diameter was < 5 mm or features of iliac vein obstruction were considered dominant; and (3) iliac vein stenting only if there was no GSV reflux with demonstrated iliac vein obstruction.[1] Raju et al found that long-term ulcer healing at 5 years was 75% overall, with no differences between the three groups. I would probably treat the GSV first, also because it can be easily and quickly done. If the common femoral vein (CFV) is not too affected with postthrombotic changes and there is good inflow from either the deep femoral vein (DFV) or femoral vein, I probably won't wait too long with stenting in case there are no signs of wound healing within 2 to 3 weeks.

Dr. Toonder: Deep venous obstruction causes a higher degree of venous hypertension than that caused by hydrostatic pressure due to valvular incompetence. Therefore, resolution of the iliac vein obstruction should be the preferred therapy. Of course, stent patency is dependent on the flow received from the affected femoral and popliteal veins. Even short-term patency may offer ample opportunity for ulcer healing. If the femoral and popliteal veins are diminished due to postthrombotic changes, even an incompetent dilated GSV can function as an important collateral. Theoretically, ablation of the GSV will not resolve the hydrostatic pressure because the deep system also has reflux.

For the patient described in the previous question, describe the technical details of intervention for chronic occlusion of the iliac vein. How do you position the patient, and what are the access location(s), preferred method of crossing the chronic occlusion, and preferred stent type and configuration?

Dr. van Rijn: I position the patient in supine position, and with duplex ultrasound, find a spot where the femoral vein is next to the artery instead of completely underneath. I position the neck in a way that I can also achieve access from the right internal jugular vein. In the leg, I make sure that the tip of the sheath (10 F) is caudal to the confluence of the DFV and femoral vein so the stent can land in the CFV if necessary. I use a hydrophilic wire and a multipurpose catheter to cross and always check once with a lateral image that my wire coursed ventral from the lumbar spine into the IVC because it can pass into spinal collateral veins. If I can't get through from below, I will also access from the neck, sometimes using a snare to catch the wire, creating a through-and-through wire. I predilate the whole segment with a 14- to 16-mm percutaneous transluminal angioplasty (PTA) balloon, but these balloons may be too big to pass initially, so a smaller diameter may be required initially. I prefer to exchange for a stiff wire (Glidewire Advantage, Terumo Interventional Systems) as soon as I have crossed the obstruction, and I do an IVUS run to mark May-Thurner, occluded and open parts of the veins, and the femoral confluence and perform multiplanar venography as well to check for collaterals (after stenting, I want to see they have disappeared). I perform PTA of the CIV with a 16-mm-diameter balloon and use a 14-mm-diameter noncompliant balloon in the external iliac vein (EIV)/CFV. If there is some stenosis in the femoral vein, I will perform PTA with a 10-mm-diameter balloon in that segment as well (in cases of severe stenosis, be certain that you have enough inflow from the DFV, otherwise the stent will block). With another IVUS run, I check to ensure my previously marked start and endpoints for stent placement are accurate. I prefer the Abre stent (Medtronic), using a 16-mm stent in the CIV and 14-mm stent in the EIV/CFV. After deployment, I postdilate the stents with the same size PTA balloon. I perform another IVUS run to check for residual stenosis in the stents and ensure the proximal and distal landing points of the stents are correct. In severe postthrombotic syndrome with extensive iliofemoral obstruction, stent extension into a single inflow vein may be a valuable option. This is usually the DFV, which has to be stented into from a jugular approach. On final venography, I check for rapid washout of contrast, with disappearance of collateral veins. During the procedure, patients are heparinized and receive low-molecular-weight heparin postprocedure in a therapeutic dose as soon as possible, as well as intermittent pneumatic compression.

Dr. Toonder: The European Venous Center Aachen-Maastricht is led by Dr. Houman Jalaie. The patient is positioned supine. Then, the ipsilateral femoral vein is accessed under ultrasound guidance at least 10 cm caudal to the femoral confluence, a 7-F introducer set is placed, 5,000 units of heparin are administered, and a stiff

Glidewire (Terumo Interventional Systems; 0.035-inch, 180-cm angled wire for routine use or a reversed 0.018-inch wire for sharp recanalization) is introduced and then replaced with a superstiff Amplatz guidewire. Then, the 7-F sheath is exchanged for a 11-F, predilation Atlas balloon (BD Interventional) at a maximum of 18 atm, and the iliac confluence is identified with fluoroscopy with contrast and/or IVUS to assess cranial landing zone and sizing. Depending on patient anatomy, stent size should be 16/18-mm diameter with 120- to 150-mm length for the CIV and 14/16-mm diameter with 100- to 120-mm length for the EIV. The 16-mm-diameter CIV and 14-mm-diameter EIV are the most commonly used configurations. Currently, Abre and the Beyond venous stents (Bentley) are used in our center. The Optimed sinus-venous stent (Optimed) is not FDA approved. Despite this, Maastricht has the largest cohort of patients treated adequately with Optimed in The Netherlands, using the 16-mm diameter and 100- to 120-mm length for the CIV and the 14-mm diameter and 100- to 120-mm length for the EIV.

Our center also has extensive experience with the Venovo stent (BD Interventional), which has been recalled due to faulty deployment issues; the Vici stent (Boston Scientific Corporation) has been recalled due to reported stent migration without clear cause. Wallstent (Boston Scientific Corporation) and Blueflow (plus medica GmbH & Co) stents tend to extend, making landing difficult at overlapping segments. I collaborate extensively with Professor Suat Doganci in Turkey, who achieves effective results using the Wallstent. He most commonly uses the 16-mm diameter for the CIV and 14-mm diameter for the EIV, with lengths of 90, 60, or 40 mm, and often lands below the ingiunal ligament without seeing stent fractures. One should always avoid overlapping stents at the inguinal ligament to avoid pain. It can be said that all stents have advantages and disadvantages that should be recognized by those deploying them. In conclusion, the preferred stent and configuration is not yet on the market and still needs to be developed.

A patient is referred with a chronic nonhealing ulcer of the right lower leg. Venous imaging demonstrated abnormal reflux in a large GSV measuring 6 to 8 mm in the calf and 8 to 10 mm in the thigh. The patient has a history of prior right leg DVT and evidence of complete occlusion of the femoral vein throughout the thigh. The CFV is open, and there is no evidence of significant obstruction of the right iliac veins. What would you recommend for this patient? Would you proceed with GSV ablation despite the occluded femoral vein, recanalize and dilate the femoral vein, or both? Or, would you have other recommendations?

Dr. van Rijn: If I really suspect that the GSV is not refluxing but serving as a collateral, I will not ablate it. Physicians are often afraid to ablate a refluxing GSV in the presence of postthrombotic changes in the femoral vein; however, if the GSV is incompetent, it will only do harm. The duplex ultrasound image of a collateral GSV is different from an insufficient GSV. However, it is sometimes difficult to be sure if the GSV is serving as a collateral or not. I have not performed PTA in patients with a solely occluded femoral vein because there is not enough evidence to support this, but results from the ACCESS PTS study are promising with respect to patency.[2]

Dr. Toonder: Deep venous obstruction causes a higher degree of venous hypertension than that caused by hydrostatic pressure due to valvular incompetence. An incompetent dilated GSV can function as an important collateral. If we consider Stevin's law, the diameter of the GSV is irrelevant. The height or length of the incompetent vein in an upright position is important. Simply formulated, when vertical, a 1-m-long tube with a diameter of 2 mm will have the same pressure value at the base when compared to a 1-m-long tube with a 12-mm diameter. Currently, there is insufficient evidence for effective femoral vein recanalization.

Do you feel that intervention is useful for occluded femoral veins in patients with chronic ulceration? If so, what technique do you prefer? Is there ever a reason to stent the femoral vein?

Dr. Toonder: As mentioned, there is currently insufficient evidence for effective femoral vein recanalization. Standard balloon dilation after crossing the femoral vein has shown to have short-term patency. Even a short-term patency may offer ample opportunity for ulcer healing. Ultrasound-assisted balloon dilation of the femoral vein momentarily has no added value compared to standard balloon dilation. Stent failure with dire patency rates in the femoral vein is the only reason not to stent.

Dr. van Rijn: I have not treated solely occluded femoral veins because of the lack of evidence to support it. I expect a bigger role for PTA than stenting in this area. I have a couple of patients in my practice with iliac vein stents also extending way down into their femoral vein (these procedures were performed years ago), but in all of them, the stents below the femoral confluence are occluded, and the proximal stents are still patent. ■

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