

[MUSIC PLAYING]

MICHAEL All right. So I'm going to talk to you today about venous insufficiency, a little bit of a change in gears from talking
MADIGAN: about arterial disease and other cardiovascular diseases. But venous insufficiency is also a very prevalent disease condition. It's found in up to a third of the adult population in developed worlds.

So as you can imagine, this is millions of people in the United States and other countries. The classic thought when you think about venous insufficiency or varicose veins, which is certainly one of the subsets of this type of disease, involves subcutaneous veins in a lower extremity. And the definition are those veins that are dilated three or more millimeters.

And when evaluating these veins, more than a half a second of reflux is considered to be pathologic. So there is a wide variety of symptoms that can go along with venous insufficiency and varicose vein symptoms, like aching, itching, burning, heaviness in the lower extremities, pain when walking, or pain even at night. The nighttime cramps that you commonly hear about can be related to symptomatic varicose veins and venous insufficiency.

There are also other complications that can arise from having varicose veins, including superficial thrombophlebitis, bleeding from veins, as well as skin changes. And this is the more severe end of the spectrum, including eczema, browning of the skin, hyperpigmentation, and ulceration in the worst situations.

So there really is a wide range of presentation with varicose veins. And we really see patients everywhere from saying that there's this one little spider vein right down by the ankle, all the way to very serious ulcerations. Fortunately, the ulcerations encompass only a very small subset of patients with varicose disease, usually about 5% or less. And most people, it's reassuring to have spider veins or small varicose veins don't actually progress to what you see on the right there. So most are not nearly that advanced.

There is a clinical scoring system that's used for both research purposes, as far as classifying the degree of disease or venous disease or venous insufficiency that you see. And it's also utilized for coming up with treatment plans for patients, because having these categories helps not only with what's going to be covered by insurance or what's not going to be covered by insurance, but also some of the more effective treatment modalities.

So on the minimal or on the side of the spectrum that has less disease starts with actually C0, which is no varicose veins.

C1 disease is considered telangiectasias, very prevalent. Most people probably have at least a few of these. They're small 0.1 to one-millimeter capillaries, venules, that are in the very superficial skin, as well as reticular veins that are defined as veins that are one to three millimeters-- so slightly larger. These are all generally considered cosmetic. Most of these, unless you get a little area that bleeds, they don't cause many long-term issues or problems.

C2 diseases, consider the bulging varicosities that you see in the image on the right, also very common. These are more common than the telangiectasias to be associated with pain and discomfort, achiness, heaviness, et cetera.

Moving down on the list, here on the left, you can see an example of somebody with edema caused by varicose veins. A lot of times, as an inpatient, you actually see this in the form of after a DVT, which causes essentially venous insufficiency, you can see significant edema related to this. But also, it can be related to superficial or deep vein reflux.

C4 disease-- again, moving down to more advanced levels of venous insufficiency and venous disease, this image right in the middle shows legs that have a lot of scaling and dryness associated with venous eczema. Some of the browning or skin changes that occur with the deposition of hemosiderin and breakdown of red blood cells that ends up permanently staining the skin is a common manifestation.

It's a little harder to appreciate to the far right, but that's an example of lipodermatosclerosis, a fancy name for, again, inflammation and scarring and damage of that tissue. The concern when you start seeing some of these changes is that we believe these patients are at more risk to ultimately go on to develop ulcerations.

C5 disease is an ulcer that is healed, and C6 denotes a venous ulcer. And this picture shows a classic example of venous ulcer disease. Classically, it's just above the medial malleolus of the ankle. But you can also see venous ulcers located laterally on the shin, posterior calf, et cetera.

Distinguishing these from other types of ulcers that you can get on the leg, your decubitus ulcers that you commonly see in patients that have been in the hospital or that are non-ambulatory, you'll typically see these more on pressure points, like the heel, the back of the calf, or sometimes the side of the foot, if they've been lying up against a bed-- and then in comparison to what you will typically see with either diabetic foot ulcerations, where you see more below the metatarsal heads on the foot or arterial disease and gangrene that you typically see at the most distal part of the foot, meaning the toes and forefoot.

So with that, I'm going to start with a few cases of some examples of how venous disease is commonly treated. So this first patient is a 41-year-old male who presented-- actually is a librarian who presented with painful bulging varicosities of the posterior thigh. As you can imagine, any time you sit, you're going to get pain and irritation of those veins located on the posterior thigh.

The patient had three months of compression, which I'll get to a little bit more down the line. But compression and elevation are some of the mainstays of treatment for symptoms related to varicose veins. The patient also had a history of hypertension and diabetes. And with that, I'm going to question the panel, since we do have some vascular providers on our panel, as to what they would perform in the next step of their evaluation.

SPEAKER 1: Venous duplex?

**MICHAEL
MADIGAN:** Very good. Very good. And this is more than just your typical venous duplex that you order a lot of times, again, in the hospital, in the ER, even in the outpatient setting, that rules out DVT is a starting point. But this also adds the reflux evaluation.

So sometimes, if you see that you get a negative DVT study and then we reorder a study, it's to add that component of reflux. And so in addition to looking at the deep system to rule out DVT, we also with this evaluation are assessing both reflux and dilation of both the deep and superficial system, again, dilation and reflux generally being categorized as more than five millimeters, with more than a half a second of reflux either in the great or small saphenous veins or deep system, as well as perforating veins that connect the two systems.

ALKHOURI: Mike, let me ask Megan. Megan, how would you actually prove that test?

MEGAN: So generally, an ultrasonographer will have the patient. They'll evaluate the deep venous system and the superficial venous system line with them standing. And then they create almost like a-- they'll either have the patient Valsalva. Or they will compress the muscular pump in the calf and try to induce reflux.

ALKHOURI: So that reflux is measured with a patient standing, and you generate that type of tension walking so you can measure the amount of blood that's retrograde coming back towards the foot. That's not the regular DVT study that we do in the hospital.

**MICHAEL
MADIGAN:** Yeah. And I think a side point to that, I don't think you can order them in the hospital. I think it has to be an outpatient study to be approved and covered, as well. So a lot of times, we do-- even if we see somebody for venous disease in the hospital and we want more information on their venous reflux studies, we actually have to see them as an outpatient to get the full and appropriate testing.

So the patient case one that we talked about had no evidence of DVT. And they had two significant findings on their reflux study, one being that the left great saphenous vein on the same side had reflux and dilation two centimeters-- or sorry, nine millimeters of reflux and two seconds of-- or nine millimeters of dilation, two seconds of reflux.

And that large bulging varicose vein that you could see on the posterior thigh was a large branch varicosity off the great saphenous vein around the posterior thigh. And that also had reflux and dilation. So what Dr. Alkhouri was referring to, these are some of the images that you'll get on a reflux test.

On the first image on the left, you can see they're measuring essentially the size-- that's on ultrasound-- and then the reflux evaluation that Megan and Dr. Alkhouri were discussing. So you first get that compression of the muscle or Valsalva. And then the reflux involves direct measurement of how long the flow is.

And essentially, what you're measuring are our veins have one-way valves that are supposed to allow blood to return back to the heart. And they're supposed to not allow blood to reflux backward by snapping shut. And so it's unclear exactly why this happens in so many people. But the valves become non-functional.

And just like you have reflux in your aortic or mitral valves, you get refluxing blood back, raising the pressure in the veins in the lower leg, especially with gravity, which results in some of the pathologic changes that we've shown.

This is the image depicting reflux in that branch varicosity, as well. And so as I talked about, the initial management in general for almost any patient that you see for varicose vein disease starts with compression. I say knee-high 20 to 30 millimeters of mercury is the standard starting point.

The patient shown before, we actually would probably give them thigh-high or even full-length, just because their varicosities are more prominent up above. But typically, the knee-high 20 to 30 are adequate, one, because they're more easy to get on than thigh-high or waist-high compression.

And the second reason is most of the swelling and symptoms do tend to occur in the calf and lower ankle and foot. And so this adding compression relieves a lot of the symptoms and can minimize some of the skin changes that are seen over time. Elevation specifically above the heart-- we tell patients they can take their compression stockings off at night and to try to, if they can, have their legs elevated above the heart.

Some of the more difficult cases of lower-extremity edema to treat are the folks that spend a lot of their days in recliners. And so basically, the whole day, gravity's working against them. And so it can be really hard, even with compression stockings, to counteract that. And so certainly, if they're able to lay flat at night or even raise or elevate their legs, it can go a long way to helping with the edema.

Light exercise-- and that helps use those muscular pumps. That helps recirculate blood through the venous system. And then as needed, and especially in the patients with ulcers, but moisturizer, as well as wound care, as well-- those are all the initial modes of treatment.

So intervention options that are most currently used, the first two are becoming more and more obsolete. But occasionally, we still use them. The first is great saphenous vein stripping. This involves making an incision near the saphenofemoral junction, as well as a counterincision.

And we pass a catheter device down the vein and directly strip it. It sounds a little medieval, but it's usually pretty well-tolerated. We do this under general anesthesia. And patients, usually after a couple weeks, the bruising resolves. And they have significant improvement in their symptoms.

Ambulatory phlebectomy, which would be one option in the patient shown above, is essentially making small stab incisions overlying the veins and directly pulling out the veins, as well. These tend to heal pretty well because they're small incisions. And the very tortuous veins that you're not able to pass a catheter through, this can be one other form of treatment that can rid somebody of their varicose veins.

More commonly nowadays, we're using more catheter-based, minimally invasive interventions. This is an example of an RFA catheter. Essentially, you're using Seldinger technique that you would use to start IV lines, et cetera, and you pass the catheter all the way along the length of the great saphenous vein or small saphenous vein within a couple centimeters to where it enters the deep system at the saphenofemoral/saphenopopliteal junction.

And then we give a tumescent solution to numb the area around the vein. And then we heat the vein up either with laser or RFA, and it shuts down and causes a clottic reaction to shut down the entire vein.

Oh, and the last one that's commonly done, you hear about spider vein injections or foam injections. We actually normally use gloves. This isn't one of our own pictures. So it's done in more of a sterile environment than this. But we use polidocanol, commonly. It's like a detergent that irritates the lining of the veins.

These are typically outpatient, again, procedures, either done with a liquid form. Or we work them up into a foam for the larger veins.

So asking again the panel, with this patient, what would be their next step in management? He's got reflux and dilation of the great saphenous vein, as well as a large branching varicosity in the posterior thigh. He's tried conservative management with compression, elevation, but clearly still has a lot of symptoms and discomfort in those veins.

So in this case, we would just go straight for the RFA ablation. I guess one part of the history I didn't give with that he has palpable-- he's 41 and has no other cardiovascular diseases, palpable pulses. There are certain situations where doing an angiogram or an arterial assessment would be very important. I'll go over that in our next patient.

But typically, nowadays, A would've been an option. But we usually favor the minimally invasive interventions, as they've shown to have efficacy of over 95%. And they're done in the office with minimal anesthesia.

ALKHOURI: And why would you actually treat the great saphenous vein if he has those branches that are the problem?

**MICHAEL
MADIGAN:** So that large branch is a branch off of the great saphenous vein. So the way-- I learned these off of Ellen Dillavou a number of years ago-- was it's like when you treat the great saphenous vein, when you have a large branching varicosity off of that vein, if you just treat that branch varicosity, it's like replacing your dropped ceiling when you have a roof leak.

So treating the great saphenous vein above that is like treating the main problem. And then the secondary problem is that varicosity branch off of it. So if you just try to treat the branch varicosity, you'll be less successful.

PHALARD: Mike, what are you telling the patient in terms of what your goal with the therapy is? Is it reduction of subsequent ulcerations?

MICHAEL Sure.

MADIGAN:

PHALARD: What morbidity down the road are you trying to prevent?

**MICHAEL
MADIGAN:** Right. With this case, it's purely reduction in symptoms. I'll show some of the studies once we get into more venous ulcerations. But for his case, it's purely for reduction of symptoms.

When we talk about venous ulcerations, the two things that we're mostly trying to achieve are, one, quicker healing with the venous ulcer and, two, reduction in recurrence of the venous ulcer.

When it comes to edema, usually-- and in all these patients, we do recommend continuing their compression and elevation lifelong. With edema, you can get some symptomatic relief. But usually, I still tell them they should be wearing compression to prevent.

SAM: Like with this type of procedure, has there ever been a phlebotic possibility?

MICHAEL Yes.

MADIGAN:

SAM: And can you get a kind of post-phlebotic syndrome, like with the DVT?

Great question, Sam. So the risk for DVT is generally quoted at 1% or less. We do repeat a venous duplex within two weeks after the initial intervention. And there's a classification system that defines basically how close the clot is to the deep system.

So again, risk is usually considered 1% or less, intervening on the great saphenous vein. It's thought that these types of near-DVTs or DVTs are less aggressive than your de novo DVT. But we still, depending on how much the clot passes into the deep system, will anticoagulate. So that's certainly a risk that's discussed upfront.

ALKHOURI: I'm going to ask Megan. Megan does see a lot of venous patients. Why do we treat those patients with compression?

This is just for insurance, or do they help with the symptoms? And this is where you set up the stage with your patient. How do you approach that particular patient?

MEGAN: So for that particular patient, he is predisposed to venous disease. You can see he's developed large, humongous, painful varicosities that he's had many years. The likelihood of him getting another one in the next one, five, 10 years is high. So he's going to have to have a strategy for managing his symptoms until his veins reach treatment size.

Also, it helps them anticipate the needs that they're going to have to fulfill after their procedure. So after all our venous treatments, 100% of them, they'll be required to wear compression afterwards. And I tell patients that their compression garments are like their glasses.

When you wear your compression garments, your symptoms are better. When you take them off, you have your same old veins, just like when you wear your glasses, you see better. And when you take them off, you have your same eyes.

**MICHAEL
MADIGAN:** I'm going to move forward. So this patient underwent both first a left great saphenous vein ablation, and this was followed up with the ultrasound-guided foam injection of the actual branch varicosity.

His follow-up ultrasound shows-- you can see it here, but there's a filling, basically a complete closure of the left great saphenous vein. And this ultrasound has the color flow that demonstrates no color flow or flow within the branch varicosity.

And this is about three months post-procedure. There were two separate foam injections that were done, but that's pre and post. And you can see he had such large varicosity, there's still a little bit of a bump there, but certainly much better than prior.

Looking at microfoam ultrasound-guided sclerotherapy for varicose veins, there aren't a lot of large studies that you might see in your typical cardiology studies. We're pretty excited about a few hundred patients that are done in a prospective way or randomized prospectively. But the average patient had about two treatments with about eight to nine cc's of foam. And a majority had resolutions of symptoms in the study.

So moving on to a second case that we talked about other potential benefits for treating varicose vein disease, this is an 87-year-old female who had a six-month history of a non-healing left ankle or shin ulcer, history of coronary disease, heart failure, hypertension, and also had a recent hospital admission for cellulitis, which you do commonly see with these venous or stasis ulcers.

This patient had difficult-to-palpate pulses and so appropriately underwent an arterial evaluation first, which you want to do in any of these patients that you can't easily palpate pulses because you want to rule out an arterial component. Even though it's not an arterial ulcer, to try to undergo compression therapy might risk actually causing worsening in the ulcer if you have arterial insufficiency.

So this patient had ABIs of greater than one, pulsatile PV, Pulse Volume, recordings all the way down to the foot, and toe pressures. We like to see at least 40. She had more than almost twice that in both lower extremities.

So she also underwent her venous duplex that showed reflux and dilation of the left great saphenous vein. And she also had an ankle perforator, which is basically a venous connection between the superficial and deep system near the venous ulceration. And these can also contribute to hypertension right around that area of the ulcer and contribute to non-healing of the wound.

So again, I'll ask the panel, what is the primary treatment modality used in wound healing for these venous/stasis wounds?

ALKHOURI: I'm going to ask Darlene. She wants me to charge everybody with it. Which one of those, Darlene?

DARLENE: I would say C, Unna boot.

ALKHOURI: Thank you very much.

**MICHAEL
MADIGAN:** Exactly. So the treatment of the venous reflux is an adjunct to good compression. And typically, we use what's called an "Unna boot." And this is an example of one here. It's a multi-layer compression dressing that's put on usually once a week. If they have a lot of drainage, we might do it twice between us and the wound center.

But this applies constant pressure to the lower extremity to avoid swelling and the constant venous hypertension that contributes to non-healing of the wound. In addition to this, again, elevation, local wound care-- there could be a whole symposium itself on just wound care.

So I'll kind of just brush over that. And then again, treatment of venous reflux, which Dr. Phalard asked earlier, what are the goals of some of these treatments? So these are some of the older trials.

But randomizing 200 patients, this was an economic analysis of a four-layer compression bandage, but also looked at comparing those that underwent four-layered or multi-layer compression bandaging versus control therapy, which is standard wound care. Comparing the two, they saw a significant reduction or significant improvement in ulcer healing in those that had the multilayer compression bandages placed.

And so in addition to the Unna boot, the patient had a great saphenous vein RFA and then followed up with a left perforator vein sclerotherapy therapy to shut down the perforator vein in that area. This is three months. I didn't have a final image, but this is three months after the treatment was initiated.

And you can see the reduction in inflammation around the wound. It's mostly closed over. There's going to be certainly some residual scarring there, but this patient would ultimately be discharged to lifelong daily compression and elevation.

And so in addition to the compression bandages, this is comparing surgery or stripping or ablation of the great saphenous vein or refluxing varicose veins plus compression versus compression alone in chronic venous ulcers, 500 patients. And there was more than twice or more than a 50% reduction in the 12-month ulcer recurrence rate between those that were treated where their veins are refluxing, superficial veins were treated, versus those that were not.

And then more recently, from *The New England Journal of Medicine*, comparing-- so historically, we used to wait until the ulcer was healed, thinking we were only preventing recurrence. This more recent trial within the last two years looked at whether doing the ablation before the wounds healed, right up front, versus waiting until the wound was healed-- so delayed versus early intervention.

And there was reduction in mean healing time from 82 days down to 56 days by treating more upfront. And so as of the last few years, we've been more aggressive about if we're deciding that or we see that the patient has significant refluxing varicose veins, we're going to go ahead and treat those kind of as soon as we can to help minimize the time that the patient has an ulcer, as these can have significant impact on the patient.

They have to have weekly Unna boot changes, sometimes hospitalizations for cellulitis, et cetera. And so we're trying to treat their veins as early as possible in order to hopefully heal their wound and keep it healed.

For the last case, I'm going to switch gears a little bit in talking about this is a patient, a 67-year-old who had extensive bilateral lower-extremity swelling, had a known history of DVT and pulmonary embolism in 2007 after a patella repair, at that time had a filter placed that remained in place for the next 10, 11 years, more recently underwent prostatectomy, and then developed swelling about two months after that was progressive and recalcitrant.

They underwent a bilateral venous duplex that showed iliofemoral DVTs in both the right and left legs. And then a follow-up CT scan showed a complete ilio caval occlusion. If you can see the red arrow here, that shows the filter in place. And the blue arrow shows that the clot not only clotted through the filter, but all the way up to the renal veins. And you can see that the renal veins are still patent, but the clot travels all the way up.

This is a little more of an advanced question. Maybe I'll ask Dr. Alkhouri. What's the next best treatment option in addition to anticoagulation and those listed below?

ALKHOURI: It sounds like the patient is symptomatic with a complete vena cava occlusion. If this is a fresh clot, the thrombolysis would be the first choice. Surgical thrombectomy is not done anymore.

Placement of a filter more proximal to this with somebody who might be hypercoagulable actually might cause more thrombosis. So systemic BPA is not indicated. I would go with the pharmacomechanical thrombolysis.

MICHAEL MADIGAN: So yeah. So this patient underwent pharmacomechanical thrombolysis. And then I'm going to skip through. I think we're, I guess, short on time.

So a lot of fancy imaging, but ultimately had stents placed after lysing the clot beyond the filter, as the filter was unable to be removed. It was a permanent filter. And they were still patent a year later on follow-up imaging.

So with that, we'll take any questions.