

VNUS CLOSURE PROCEDURE
MINIMALLY INVASIVE PROCEDURE TO TREAT VARICOSE VEINS
RUSH UNIVERSITY MEDICAL CENTER, CHICAGO, ILLINOIS
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NARRATOR

The return of warm weather can be a difficult time for people who suffer with unsightly varicose veins. Now a new minimally invasive treatment offers help for these patients. During this live webcast, surgeons at Rush University Medical Center in Chicago, Illinois, will perform a VNUS closure procedure for the treatment of varicose veins.

CHAD JACOBS, M.D.

The VNUS closure procedure is a minimally invasive method of treating incompetent saphenous veins, which is the main cause of varicose veins.

NARRATOR

The procedure is performed with one small incision. A thin wire is inserted into the saphenous vein using ultrasound guidance and then a radiofrequency probe is advanced along the wire. The device ablates the swollen vein, completely destroying it.

WALTER McCARTHY, M.D.

The recovery from this radiofrequency catheter is almost immediate, which is quite remarkable.

NARRATOR

At any time throughout this program, you may email question to the physicians by clicking the MDirectAccess button on the screen.

MARSHALL GOLDIN, M.D.

Good afternoon. Welcome to Rush University Medical Center in Chicago. Today we will be performing a VNUS closure procedure to obliterate varicose veins in the lower extremity. I am Marshall Goldin, cardiovascular surgeon at Rush University Medical Center and this procedure will be performed today by two of my associates, Dr. Walter

McCarthy and Dr. Chad Jacobs. Dr. McCarthy, in the operating room, would you please say hello and introduce your team to the viewing audience?

WALTER McCARTHY, M.D.

How are you Dr. Goldin?

MARSHALL GOLDIN, M.D.

:00 I'm well. How are you?

WALTER McCARTHY, M.D.

I'm here with Chad Jacobs, Dr. Jacobs, and our scrub nurse is Diane Trexler and running the ultrasound is Jennifer Robertson.

CHAD JACOBS, M.D.

Hi, I'm Dr. Chad Jacobs, one of the vascular surgeons here at Rush. Our anesthesia team is headed by Dr. Biala and Dr. Lefkowitz. Dr. Goldin, back to you for a moment.

MARSHALL GOLDIN, M.D.

Just a little history to give the viewing audience an idea what varicose veins are like. About 15% of all males and 30% of females do have varicose veins. There's a tendency for this process to occur in families and it particularly occurs in people who stand on their feet during their professional life. Frequent symptoms include tired, aching legs, swelling of the legs and frequent episodes of phlebitis. We have just a little clip which shows what varicose veins are caused by.

NARRATOR

Your legs are made up of a network of veins. A healthy vein contains vein valves, which open and close to assist the return of blood to the heart. Varicose veins are caused by damaged valves, which result in backward flow of blood in your legs, a condition known as venous reflux. This can cause blood to pool in your legs and lead to symptoms such as pain, swelling and varicose veins.

MARSHALL GOLDIN, M.D.

On this slide we see the result of chronic varicose veins. On the left frame we see the varicose veins that are so often evident on the legs of patients with this process and a large proportion of these patients will ultimately end up with swollen legs. As the years go by, as blood breaks down and is deposited in the leg, you see the skin changes, that is increased thickening and darkening of the skin and the last stage is ulceration of the leg. This is a very common problem which we see on a daily basis. Now that we have this

minimally invasive procedure to take care of these veins, the procedure is much less uncomfortable and requires much less time in the hospital. Dr. McCarthy, how are we doing in the operating room and where are you in your procedure?

WALTER McCARTHY, M.D.

Well, you know, we're doing very well. We've got a 025 wire up through the vein and we can see it now on the ultrasound machine up at the saphenofemoral junction. What we're doing is we're getting the radiofrequency catheter out. We mapped the saphenous vein before we got started here and found that it's about 9 or 10 mm in diameter so we're going to use the larger catheter, we're going to use the 8 French system. We're just getting that out now. That catheter will go up over the wire.

MARSHALL GOLDIN, M.D.

We have a slide which shows the device that Dr. McCarthy and Dr. Jacobs are going to use. On the slide we can see first the catheter is placed up into the saphenous vein near the groin and when it's in the exact proper place, electrodes are deployed into the vein and then an electrical energy is utilized to cause the vein to be destroyed and to close down on itself. So ultimately as the weeks and months go by, the vein ultimately will look as it does on the right side of the slide.

In this slide, we see that the vein prior to treatment is irregular. It has an abnormal surface and then following coagulation by our radiofrequency process, the vein is completely obliterated, no longer carries blood and this is in the process of dissolution or fibrosis, ultimately, of this vein.

The process takes approximately an hour. The majority of patients are out of the hospital on the same day of surgery and about 75-85% of the patients that undergo this procedure return to full activity and to work within 24-48 hours. In comparison, in the past, the standard vein-stripping procedure required 2-3 hours. Not infrequently the patient did require an overnight hospitalization, but with this procedure the recovery is less, the discomfort is less and there are virtually no scars. Dr. McCarthy, are you just about ready to start the process?

WALTER McCARTHY, M.D.

Yes, the catheter has been advanced up through the sheath and we've got it over the wire. We're just going to check its location with the ultrasound. There's actually a good image on the ultrasound machine here.

CHAD JACOBS, M.D.

That central lucency that you see, that's the J-wire and as you see I advance it there, you can see it going right through the saphenofemoral junction. One of the most important steps in this procedure is that we want to make sure that we deploy the device just in the

saphenofemoral junction and just beyond the first branch, which is called the superficial epigastric branch. So that's the most important step right now, is that we're making sure we have our device exactly where we want it to be.

MARSHALL GOLDIN, M.D.

So going back to this slide, we see that the electrodes vary in size. The 6 French, and the 8 French one is a slight bit larger than the other. This device is used exactly at the very beginning of this vein in order to avoid injury to the deep vein and prevent any clot from forming in the large vein in the groin. As this device is removed on a very slow basis, the entire vein will fibrose and collapse as the device is removed. Are you ready to start coagulating the vein? It's very important to—

CHAD JACOBS, M.D.

We are just confirming the final placement of the catheter tip before we get started with the coagulation.

MARSHALL GOLDIN, M.D.

Now have you given the tumescent anesthesia yet, Dr. Jacobs?

CHAD JACOBS, M.D.

What we do is as soon as we get our catheter in the right position, we then administer the tumescent anesthesia and we'll show you that momentarily. The reason for that is that sometimes the tumescent anesthesia makes it difficult to visualize the vein. So what we like to do is we like to get everything set up perfectly and then give the tumescent anesthesia. As you'll see, there are multiple points along which we keep confirming our placement here.

MARSHALL GOLDIN, M.D.

One of the reasons for the tumescent anesthesia is one, the local anesthesia, and two, to make certain that there's enough difference between the vein and the skin overlying. It should be a quarter to three-eighths of an inch of distance, closer to three-eighths of an inch of distance, between the vein and the surface of the skin because the heat that is formed during the radiofrequency ablation can cause skin damage and discomfort. So this is an integral part of the procedure and with the Doppler ultrasound, the amount of distance between the electrode, the vein and the skin is very carefully monitored. Have you given any of the anesthesia yet, Dr. McCarthy?

WALTER McCARTHY, M.D.

Could you repeat that Dr. Goldin? No, we haven't used any of the tumescent yet. It's quite interesting because we actually follow the injection of the tumescent solution with

the ultrasound. The concept is that this acts as a thermal sink so that the heat from the probe itself doesn't damage the skin or any adjacent nerves. What we do is we inject it under pressure and then we follow the expansion of the tissue with the ultrasound here.

MARSHALL GOLDIN, M.D.

Now is this patient asleep?

CHAD JACOBS, M.D.

Yes, she is. She has, I believe, a Laryngeal Mask Airway.

MARSHALL GOLDIN, M.D.

Do all patients require anesthesia for this procedure?

CHAD JACOBS, M.D.

No, this procedure actually—it depends on the extent of what's being done. This procedure can be done, in terms of the radiofrequency ablation, can be done just under local anesthesia. This patient is actually going to require stab phlebectomy of some of the larger varicose veins in her calf and for that reason, she's going to be receiving general anesthesia.

MARSHALL GOLDIN, M.D.

Dr. Jacobs, what is stab phlebectomy?

CHAD JACOBS, M.D.

Stab phlebectomy is a technique whereby we remove the larger varicose veins in the calf area. Those are done through ¼-inch incisions every 5-6 inches and then the varicose veins in the calf are removed manually.

WALTER McCARTHY, M.D.

You can see here with the ultrasound, if you wanted to go back to it, you can see the infusion of the tumescent solution which infiltrates underneath the skin and the soft tissue between the skin and the catheter and around the catheter which is inside the saphenous vein.

MARSHALL GOLDIN, M.D.

So if this patient were awake, there would still be no sensation because of the anesthesia that you're giving, is that correct?

WALTER McCARTHY, M.D.

Repeat that, Dr. Goldin.

CHAD JACOBS, M.D.

Can you repeat that question, please?

MARSHALL GOLDIN, M.D.

If the patient were awake, would this anesthesia be adequate to obviate any pain during the procedure? So in general, these patients are either asleep or they have spinal or epidural anesthesia.

CHAD JACOBS, M.D.

That's correct. That's usually what we use.

MARSHALL GOLDIN, M.D.

Pardon me, Dr. Jacobs? I'll continue on. The vast majority of these patients have spinal or epidural anesthesia so the recovery period is one or two or three hours and these patients can get up, walk to the car and be driven home. The amount of time in the hospital is minimal. It's important to note that these patients come in the same morning of surgery and they're out the afternoon or the evening of the surgical procedure.

So have we finished with the injection of the tumescent anesthesia?

WALTER McCARTHY, M.D.

We're getting close, Dr. Goldin. We've got it up through most of the thigh. The other thing we do her is we put the patient in Trendelenberg position with her feet up somewhat so that the blood runs out of the legs. And then what we're going to do is when we get up toward the top of the leg, we're going to recheck our catheter position and if it looks perfect, then we'll go ahead and inject the tumescent up at that point. So I'm going to start taking a look at the top here.

MARSHALL GOLDIN, M.D.

So what is the reason for tipping the patient with the legs up in the Trendelenberg position?

CHAD JACOBS, M.D.

That allows the blood to drain back to the patient's body and out of the legs and it helps compress the vein, which gives the radiofrequency catheter better contact against the vein wall and assures a more complete ablation of the vein.

MARSHALL GOLDIN, M.D.

So you use several modes to collapse the vein. One is the injection of fluid around the vein.

CHAD JACOBS, M.D.

We try and get at least a 2 cm cushion between the vein and the skin. The other thing that we try and do is we try and actually get the anesthesia within the fascial envelope that contains the vein to assist with compression of the vein itself.

MARSHALL GOLDIN, M.D.

We have a little film clip which shows how the vein is obliterated.

NARRATOR

The closure catheter is introduced into the refluxing vein and is navigated and positioned at the saphenofemoral junction under ultrasound guidance. Catheter electrodes are deployed, contacting the vein wall. Tumescence anesthesia is injected up the vein into the saphenous compartment to provide skin protection, exsanguination and compression of the vein onto the electrodes. RF energy is turned on and pullback begins. This controlled heating of the vein wall causes shortening and thickening of collagen fibrils to help shrink the vein. Endothelium is denuded and the vein lumen is acutely narrowed. This stimulates fibrotic sealing and occlusion of the vein. When the electrodes reach the introducer sheath, RF energy is turned off and the catheter removed. The fibrotically occluded vein is resorbed by the surrounding tissue.

MARSHALL GOLDIN, M.D.

So you now have seen exactly what Dr. McCarthy and Dr. Jacobs are going to do when they use the radiofrequency power to obliterate the vein. It's essential that the vein be totally empty or as empty as possible so that the electrical energy can be transmitted to the vein wall and not into the blood, which would serve, partly at least, as an insulating mechanism and impair the process. The catheter with the electrode is removed very slowly through the first four to five minutes, during which it is moved about a half-inch to an inch at a time every two to three minutes. This is because the catheter is relatively small in comparison to the size of the vein at the upper portion.

Please allow me to remind everyone to use the MDirectAccess mode on your computer screen in order to ask questions. We do have one question, actually, already. One of the questions is: is this procedure covered by health insurance? This, of course, depends upon

the type of insurance that each individual has. Most insurance carriers do cover this procedure in patients who have pain, significant discomfort, edema disability, ulcerations of the lower extremities. But this is a process that must be done, in general, ahead of time before the patient is admitted to the hospital.

Another question is the recovery time. I think we've already covered the fact that the vast majority of patients are out the same day and almost all patients return to full level of activity and work within 24-48 hours. In general these patients have no bleeding into the leg, no discoloration since everything is done from the inside of the vein.

Another question is: is this procedure done outside of the United States? I believe that there are some institutions in other countries that have begun to use this process. We've been very happy, I think, altogether we've done 80 or 90 cases exactly of this type. So far in re-evaluating these patients, we have had no recurrences of varicosities. Dr. McCarthy, how are we doing? Have we started the radiofrequency ablation?

CHAD JACOBS, M.D.

We have. We've started the radiofrequency ablation. We gave the tumescent anesthesia along the entire length of the leg and now we've started the radiofrequency ablation. I'm not sure if you can see this with the camera, but what we're looking at is we're looking at the monitor, which shows us both the temperature of our catheter as well as the impedance, which shows us how good of a seal we're getting between the catheter device tip and the walls of the vein. The two numbers that we're looking at are the middle two, which right now shows 84 and 132. We like that impedance to be greater than 100, which shows us a good vein wall contact. We also want the temperature to be in the 80-degree range.

MARSHALL GOLDIN, M.D.

That's 80 degrees Fahrenheit or Centigrade?

CHAD JACOBS, M.D.

Celsius.

MARSHALL GOLDIN, M.D.

That's almost boiling.

CHAD JACOBS, M.D.

Yeah, that's warm. That's one of the reasons why we want to make sure that there's adequate distance between the vein and the skin.

WALTER McCARTHY, M.D.

So the nice thing about this technique is that the catheter actually turns itself on and off depending on the temperature, so there's a feedback loop that keeps the temperature right in the range where we want it.

MARSHALL GOLDIN, M.D.

So you set the temperature ahead of time or does the machine set the temperature for you?

CHAD JACOBS, M.D.

The machine autoregulates the temperature setting.

MARSHALL GOLDIN, M.D.

So it's kind of a failsafe mechanism to have the right temperature or notify you if the temperature is incorrect.

CHAD JACOBS, M.D.

Correct. If the temperature gets too high or the impedance gets too high, it automatically stops delivering the radiofrequency current.

MARSHALL GOLDIN, M.D.

And then what's your mechanism to test to see if you've had satisfactory obliteration of this vein?

WALTER McCARTHY, M.D.

We go back afterwards and take a look at it with the ultrasound.

MARSHALL GOLDIN, M.D.

So you review the ultrasound as you're doing the procedure, and then when is the next time that you do an ultrasound to see if it is still a successful operation?

CHAD JACOBS, M.D.

Once they come back and see us on their first postoperative visit, which is usually approximately two weeks afterwards, we have them get an ultrasound that same day.

MARSHALL GOLDIN, M.D.

And have we had any recurrences, to your knowledge?

CHAD JACOBS, M.D.

In our two-year experience, we haven't had any recurrence and we haven't had any DVT as a result of this procedure.

MARSHALL GOLDIN, M.D.

We have another question from the Internet. Is this procedure utilized in the lower portion of the leg between the knee and the calf also? If not, why not?

WALTER McCARTHY, M.D.

Normally we don't use it there because there are cutaneous nerves in that area and really to obliterate the refluxing part of the saphenous vein, it's only necessary to do it between the upper thigh and the knee.

MARSHALL GOLDIN, M.D.

And also, isn't the skin in the lower part of the leg somewhat thinner and therefore we would have less insulation?

WALTER McCARTHY, M.D.

:00 You're right about that.

MARSHALL GOLDIN, M.D.

So, in general, the veins in the lower part of the leg require more of a direct activity, such as removal.

WALTER McCARTHY, M.D.

You going up to 2 cm a minute now? Because it's going, I can actually feel it.

MARSHALL GOLDIN, M.D.

Dr. McCarthy, what are the options as far as removing varicose veins in the lower part of the leg?

CHAD JACOBS, M.D.

Can you repeat that question, please?

MARSHALL GOLDIN, M.D.

What are the options in regard to removing varicosities in the lower part of the leg?

CHAD JACOBS, M.D.

Well, there are several options that we have, in terms of taking care of large varicosities in the lower part of the leg. One of the most common methods that we use is to remove them in the operating room. One of the advantages of that is we can do it simultaneously with this closure radiofrequency procedure. But it can also be done in an outpatient setting by injecting those varicose veins. They can be injected with different solutions, we prefer the sodium tetradecyl foam which has been shown to ablate those varicose veins quite well.

MARSHALL GOLDIN, M.D.

We have another question. What is our opinion regarding the endovenous laser therapy?
Dr. McCarthy?

WALTER McCARTHY, M.D.

Would you just repeat that, Dr. Goldin?

MARSHALL GOLDIN, M.D.

Have we used the endovenous laser procedure?

WALTER McCARTHY, M.D.

Repeat that again.

MARSHALL GOLDIN, M.D.

How is the endovenous laser procedure?

WALTER McCARTHY, M.D.

The Endolaser procedure is similar. They're simply two different ways of delivering the temperature to the end of a catheter. The reason that we are currently using this device is because of that feedback loop that I was telling you about, where the temperature goes up and it goes down to keep it right steady at 85 where we want it to be. Whereas with the laser, the temperature is pretty much on its own and there's no controlling it.

MARSHALL GOLDIN, M.D.

So it seems like the laser goes where it wants to and the heat is whatever it wants to be and there is much less control as far as feedback from the electronics.

Here we have a slide that shows in red, you see the common femoral artery, which is the main blood supply to the leg in the groin. The common femoral vein, which is labeled CFV, which is the vein that removes and takes back the majority of the blood from the leg. And GSV is the saphenous vein that, in this case, has already been obliterated.

In this next slide you can see, again, the common femoral vein, the junction where the procedure originates and then just past that is the saphenous vein and in the post-treatment frame on the right, the green arrow shows the fact that there's no longer any blood flow traveling through the greater saphenous vein. So this is an example of what this patient's ultrasound will look like at the end of this procedure and at the time of her repeat examination in two to three weeks. In general, the vast majority of these patients have complete obliteration of all of their veins within one to two years. 90-95% of all of these patients are totally free of symptoms, free of edema, free of pain, free of numbness and tingling. In an ultrasound, it is extremely rare to see any patency of any of these vessels.

Have we finished, Dr. McCarthy? I think I see that the catheter has been withdrawn?

CHAD JACOBS, M.D.

Well, what happens sometimes, especially when we use the larger device, is that the device gets some coagulation on it and the device temporarily shuts itself off when it senses that it's become occluded. So what we've done is we've put the wire back up about halfway because we've completed about half of the radiofrequency ablation and we're cleaning off the tip of the catheter and if the cameras can focus on this, you can see that the catheter is like a Christmas tree configuration. All of this coagulated blood builds up on the catheter and that's a result of that radiofrequency ablation of the walls of the vein. So periodically, you have to clean this off because it automatically shuts off when it detects that buildup on there.

WALTER McCARTHY, M.D.

I'd say that in most cases, we do this at least once. Okay, it looks good. So we're going to close the catheter up. If you can see it. Let's close it up. This is a nice opportunity for people to see what the catheter looks like, actually. We close it back into its sheath and we're going to—I'll hold the wire—Chad? And we'll just advance it back up there.

MARSHALL GOLDIN, M.D.

We have another question from the viewing audience. This question asks is there a specific age at which we do not recommend this procedure? We really don't have an age limit, however, the important considerations include the general health of the patient, whether or not the patient has any coronary heart disease, congestive failure, any vascular disease in the legs, etcetera, etcetera. So there isn't really an age limit, but our restrictions are dependent upon the general health of the patient. Any patient that requires or would consider this procedure should, of course, be seen first by their primary care physician.

Another question is: are there any further measures that are taken to help a patient's circulation when the varicose veins are obliterated? This is a very important question. The fact of the matter is, when patients have varicose veins, these veins are generally nonfunctional or not functional in a very good way. So removal of those veins actually improves the patient's circulation. Veins serve to bring blood back from the leg to the heart to the body to be used once again in the circulation. There are also larger, deeper veins within the leg that also provide this function. So we have an outer, external, or superficial group of veins as well as the deep veins in the leg. The majority of patients can have the outer veins removed when they're abnormal and the deep veins are sufficient to provide most of this function. Dr. McCarthy, have we gotten almost to the end of the procedure?

CHAD JACOBS, M.D.

Well, we probably have another good 10 to 15 minutes of radiofrequency to complete. At this point we're going at 2 cm per minute and that slow rate of pullback insures that we have complete coaptation of the two walls of the saphenous vein. The first five centimeters are done 1 per minute to insure that the saphenofemoral junction is completely isolated.

MARSHALL GOLDIN, M.D.

So from the time that we finish and the patient is discharged, are there routine postoperative orders for these patients as far as restrictions of activity, etcetera, etcetera?

CHAD JACOBS, M.D.

Usually there's not much of a restriction of activity. In the first 48 hours, we usually recommend that the patient sort of keep their legs elevated and try to do as little activity as possible. Within 48 hours, most patients are able to return to their normal activities.

MARSHALL GOLDIN, M.D.

How about the complications associated with this procedure?

CHAD JACOBS, M.D.

Fortunately, the complications are very rare and that's one of the reasons we like this procedure, as do our patients. Sometimes patients get a little bit of numbness in the inner thigh, which is from some of the heat that can affect the nerves in that area. Fortunately it's a transient numbness and usually it resolves on its own within the course of 4 to 6 weeks.

WALTER McCARTHY, M.D.

The other thing that's been reported is the venous thrombosis, but as we said earlier, we have not seen that in our own patients, although it has been reported rarely in the literature.

MARSHALL GOLDIN, M.D.

So, Dr. Jacobs, if you or if your wife had to have varicose veins removed from the leg, how would you prefer to remove the veins between the knee and the ankle? You did describe some of the ways, but which seems to be the best way? Do you use the same way in every patient or do you tailor the operation to the patient?

CHAD JACOBS, M.D.

We always try and tailor the operation to the patient with our first concern to be doing what's best for the individual patient. So for some patients that may be a staged procedure where first we remove the saphenous vein with the radiofrequency closure and then in a staged procedure, remove the below-knee varicose veins with either stab phlebectomy or injection. In some patients, like the one you're seeing today, the best option is to do them simultaneously and avoid having them have to return for a second procedure later on.

MARSHALL GOLDIN, M.D.

How much scarring occurs with the stab phlebectomy?

CHAD JACOBS, M.D.

The scars are less than a quarter of an inch big and they usually heal without being noticeable at all over the course of six weeks.

MARSHALL GOLDIN, M.D.

Do you use stitches or staples when you do this stab phlebectomy procedure?

CHAD JACOBS, M.D.

We use sutures that are dissolvable and are placed under the skin, so there's no sutures that need to be removed. There's no other care for the wounds that need to be performed. The sutures dissolve on their own over the course of weeks and the skin heals beautifully and most patients, within two months after the surgery, you can't even tell that they've ever had any incisions there at all.

WALTER McCARTHY, M.D.

We actually have a technique where we can make a very tiny incision, even smaller than what Dr. Jacobs was talking about. We use some special little hooks that allow you to

grasp the vein and bring it up through the skin which we can often use and therefore really minimize the size of the incision.

MARSHALL GOLDIN, M.D.

I understand we have some new viewers since we started and I would like to play once again the endovenous ablation procedure so that everyone can have a better idea of what this procedure includes.

NARRATOR

The closure catheter is introduced into the refluxing vein and is navigated and positioned at the saphenofemoral junction under ultrasound guidance. Catheter electrodes are deployed, contacting the vein wall. Tumescence anesthesia is injected up the vein into the saphenous compartment to provide skin protection, exsanguination and compression of the vein onto the electrodes. RF energy is turned on and pullback begins. This controlled heating of the vein wall causes shortening and thickening of collagen fibrils to help shrink the vein. Endothelium is denuded and the vein lumen is acutely narrowed. This stimulates fibrotic sealing and occlusion of the vein. When the electrodes reach the introducer sheath, RF energy is turned off and the catheter removed. The fibrotically occluded vein is resorbed by the surrounding tissue.

MARSHALL GOLDIN, M.D.

So we've shown once again what the procedure entails. Dr. McCarthy and Dr. Jacobs are almost to the point of removing the catheter. You did see that it was necessary to clean the electrodes once, only infrequently is it necessary to clean the electrodes again a second time in order to complete the procedure. Here we have a slide showing the pre- and the post-photograph of a patient who had both above-the-knee as well as below-the-knee varicosities. The upper varicosities were treated with the RF endoablation procedure and this patient did have stab phlebectomies, that is tiny, tiny incisions—less than a quarter of an inch—and a little hook was used to remove each of these varicosities. So the slide on the right shows what the patient's leg looks like just one week following the procedure.

CHAD JACOBS, M.D.

What we're doing here is our final scan. If the cameras can show us the ultrasound, the saphenous vein, we're up there at the saphenofemoral junction—

WALTER McCARTHY, M.D.

I'm going to compress that and you can see the common femoral vein is compressing nicely.

CHAD JACOBS, M.D.

Whereas before we were able to see a nice, long branch of the saphenous vein descending and that's as we're passing the saphenofemoral junction—

WALTER McCARTHY, M.D.

And now it just disappears and you really—it's almost hard—it's right there in the center of the screen where there's a bright section—but you really can't see much of it. It's completely contracted and basically completely obliterated.

CHAD JACOBS, M.D.

That's the residual saphenous vein.

WALTER McCARTHY, M.D.

Yeah.

CHAD JACOBS, M.D.

No flow and completely thrombosed, essentially. And what we do is we scan down the entire length to be sure that we've completely treated the entire saphenous vein because if it seems as if there's a segment that needs to be retreated, we can simply reinsert the wire and the device and perform a second treatment right here.

WALTER McCARTHY, M.D.

There's the—I think it's right there—the bright—there's a little bit of air—yeah—shriveled.

CHAD JACOBS, M.D.

Yeah. Yeah.

MARSHALL GOLDIN, M.D.

So it looks like we're 90+% complete as far as obliteration of the vein.

WALTER McCARTHY, M.D.

And there's our sheath. You can see the sheath in the longitudinal image there. The vein is very nicely obliterated. We're going to end this part of the procedure now and get on with the extraction of the veins in the calf.

MARSHALL GOLDIN, M.D.

We have another question, Dr. McCarthy. Does stab phlebectomy cause increase in the recovery time following that portion of the procedure?

WALTER McCARTHY, M.D.

Say that one more time, Dr. Goldin?

MARSHALL GOLDIN, M.D.

Does stab phlebectomy increase the length of recovery time?

WALTER McCARTHY, M.D.

You know it does, it actually does increase the length of recovery time. If there's nothing done other than the radiofrequency treatment, the recovery time is almost nil. Patients are in good shape within a day or so. But the stab phlebectomy requires that the patient be inactive for a couple of days and then take it easy for another week or so after that.

Now what we're going to do here is we're going to—we're placing a sterile tourniquet and this is a technique that has been adapted from the orthopedic procedures that are done with tourniquets and this allows us to remove the large diameter varicose veins in this patient's leg without any significant blood loss.

MARSHALL GOLDIN, M.D.

As the tourniquet is being applied, of course, the reason for this is to minimize any blood loss during removal of the veins from the lower part of the leg. Dr. Jacobs is wrapping the leg with a tight elastic bandage in order to compress the veins of the leg, remove as much blood from the leg as possible and then once the leg has been compressed and the vessels have been compressed, then the tourniquet is activated and that prevents any further blood from entering the leg. So this cuts down on blood loss easily by 90%. So this removal of the blood prevents number one, blood loss, and it also prevents loss of blood into the tissue as the veins are removed.

We have a slide here in regard to how patients evaluate the operative procedure. 99 or 98% of all patients who have this procedure done are prone to recommend the procedure to their friends and family. Pain, fatigue and edema are the most common symptoms which result in requesting this operation and in the vast majority of patients, these symptoms are almost entirely relieved within the first week. By the end of one year, less than 10% of patients have any complaints at all.

We have another question from our audience. What effect would having knee replacement before or after the VNUS procedure have on whether or not these two procedures can be done one after or before the other? These are two totally different processes. One would anticipate that if the knee surgery is done, one would wait probably

3-6 months before considering any vein surgery just in order to be certain that patient has no clot or phlebitis within the deep veins of the leg. And in similar fashion, one would not want to do knee surgery shortly after doing vein surgery, especially since the knee surgery, in most cases, is a much more major operative procedure.

Dr. McCarthy, what are all those marks on this patient's leg?

WALTER McCARTHY, M.D.

Would you mind repeating that Dr. Goldin?

MARSHALL GOLDIN, M.D.

You have a lot of marks. What are all those marks on the patient's leg?

WALTER McCARTHY, M.D.

With the patient standing beforehand, we can see the varicose veins very nicely and obviously when they're laying down like this, you can't see them. We take an indelible marker and we mark around the veins with them standing. That was done just an hour or two ago.

MARSHALL GOLDIN, M.D.

So this is a roadmap so that you know where the varicosities are. Is that correct?

CHAD JACOBS, M.D.

Yes, that's correct and that's done in the holding area right before we bring the patient back for surgery.

MARSHALL GOLDIN, M.D.

And the patient is still asleep?

CHAD JACOBS, M.D.

Could you repeat that, please?

MARSHALL GOLDIN, M.D.

I assume the patient is still asleep for this part of the operation.

CHAD JACOBS, M.D.

Yes, and this is the reason why this patient is having general anesthesia, because of this part of the procedure. If we were just doing the upper part of the procedure, then this patient would have been able to just have this done under local anesthesia.

MARSHALL GOLDIN, M.D.

Is that the vein that I see there, Dr. McCarthy?

WALTER McCARTHY, M.D.

Repeat that, Dr. Goldin?

MARSHALL GOLDIN, M.D.

Is that the vein?

WALTER McCARTHY, M.D.

:00 Yes, I think you might be able to see the actual varicose vein here coming out. Scissors.

MARSHALL GOLDIN, M.D.

It looks a lot smaller than the viewing audience would expect. Is that right? Why is it so small?

WALTER McCARTHY, M.D.

They go into spasms. When the patient's standing, they increase in diameter by a factor of 3 or 4, another reason for marking them so carefully before we get started.

MARSHALL GOLDIN, M.D.

Do you make an attempt to make all the incisions in the same direction so that the scars will be less evident?

WALTER McCARTHY, M.D.

The incisions can be made in any direction, but we like to make them typically longitudinally, up and down, because they're less visible.

MARSHALL GOLDIN, M.D.

How big are the scars?

CHAD JACOBS, M.D.

The scars are nearly non-detectable.

MARSHALL GOLDIN, M.D.

Do patients require special stockings after the surgery? Do they require elastic bandages? Are there any appliances that are necessary?

WALTER McCARTHY, M.D.

We prefer to use elastic bandages. Some sort of elastic compression is necessary. The patients who have had a lot of leg swelling before they have their vein operation sometimes will use an elastic bandage for a while afterwards, too. Otherwise people use the elastic compression bandages for 2 or 3 weeks after the operation.

MARSHALL GOLDIN, M.D.

How about returning to the health club? Can these patients go back on the treadmill relatively rapidly after vein surgery?

CHAD JACOBS, M.D.

They sure can. After the initial recovery phase, these patients can return to exercise and whether that's vigorous activity or not, they can basically return to their usual activities of daily living.

WALTER McCARTHY, M.D.

If they've had the stab phlebectomy, typically there is some black and blue afterwards and the black and blue usually takes 3 or 4 weeks to completely resolve. People who are vigorous athletes usually will hold off on, for example, downhill skiing, for about 4 weeks after this, but otherwise they go back to routine exercise within about 2 weeks.

MARSHALL GOLDIN, M.D.

Do these patients require blood thinners to prevent clots from forming in the remaining veins in the legs?

CHAD JACOBS, M.D.

Can you repeat that, please?

MARSHALL GOLDIN, M.D.

Do these patients require blood thinners to prevent clots in the legs? We know that some patients, for example after knee surgery and hip surgery, are treated with blood thinners to prevent clotting due to the inactivity.

CHAD JACOBS, M.D.

No, typically these patients do not require any form of blood thinning.

WALTER McCARTHY, M.D.

The elastic compression, of course, helps in that area.

MARSHALL GOLDIN, M.D.

Is the chronic swelling improved after removal of these veins?

WALTER McCARTHY, M.D.

Patients who have insufficiency of their superficial system only, and not of their deep system, theoretically are quite improved related to swelling, once they have the saphenous vein obliterated because the swelling is a result of the retrograde flow and the backpressure in the superficial system. The patients who have a lot of insufficiency of their deep system are not helped as much from it so we always evaluate the patients beforehand with duplex ultrasound to see what the extent of the reflux in the deep system is.

MARSHALL GOLDIN, M.D.

How about the skin changes and the pigmentation and the thickening of the skin? Do those processes resolve after doing this kind of surgery?

WALTER McCARTHY, M.D.

Repeat that, please.

MARSHALL GOLDIN, M.D.

After this kind of surgery, do skin ulcerations and thickening of the skin resolve? We can see at the bottom of the frame, just under your left hand, that there's a fair amount of dark pigmentation of the skin. Can you point that out for us?

WALTER McCARTHY, M.D.

Yeah. The pigmentation is from venous insufficiency. You can see that this lady has had this for years. The pigmentation is quite permanent and we don't usually promise them

that the pigmentation is going to go away. It sometimes does reduce in intensity, however.

MARSHALL GOLDIN, M.D.

Why does this pigmentation occur?

WALTER McCARTHY, M.D.

:00 Because of the venous hypertension at the ankle. There are some blood products that leak out of the vessels. The pigment is actually from the hemoglobin. It's from the red blood cells that break down under the skin and then that pigment turns brown under the skin. It's a fairly permanent stain.

MARSHALL GOLDIN, M.D.

Would you ever do a skin graft with this kind of problem?

WALTER McCARTHY, M.D.

Repeat— Well, this lady, of course, doesn't have skin breakdown, she just has the pigmentation, so we wouldn't use a skin graft. But for patients who do have ulceration, we try to, before we treat the veins, we try to achieve healing of the ulcers and occasionally we do use skin grafts.

MARSHALL GOLDIN, M.D.

So where do the ulcerations generally occur and why?

WALTER McCARTHY, M.D.

They occur exactly where her pigmentation is, so they occur just above the medial malleolus, the medial ankle bone. They occur there because of some perforators that come from the deep system and leak high-pressure blood out and they cause all this—the blood products to stain the skin and damage the skin. That's where people get them and it's most common to have them right exactly where she has it.

MARSHALL GOLDIN, M.D.

Dr. Jacobs, I heard Dr. McCarthy say perforator. What is a perforator?

WALTER McCARTHY, M.D.

The perforating veins are—the deep veins inside the leg are connected to the ones underneath the skin so that the blood can flow from the skin back into the deep system. The little veins that connect them perforate, so they're called perforators. These

perforators can transmit the pressure from inside the leg out to the skin and are the culprits in causing a lot of this ulceration problem and the pigmentation of the skin in this area.

MARSHALL GOLDIN, M.D.

So, Dr. McCarthy, what happens now if this patient down the way, say, in a year or two, or five or ten years, needs a coronary bypass? What do we do as far as using veins to perform a coronary bypass operation?

WALTER McCARTHY, M.D.

Well, the saphenous vein that's varicosed does not make good bypass material and if she needs to have open-heart surgery or other bypass surgery then we would use the vein possibly from her other leg or we could use her arm veins or we could use the internal mammary artery or the radial artery, so there's a lot of other conduit that's useful.

MARSHALL GOLDIN, M.D.

But in general, these veins are never removed, since clearly they're a natural resource, unless there is symptomatology associated with the veins. Is that correct?

CHAD JACOBS, M.D.

Yes, that is correct.

MARSHALL GOLDIN, M.D.

We have a question again from the audience. How can we be sure that the saphenous circulation is not essential? Is there enough collateral venous circulation?

CHAD JACOBS, M.D.

Yes. As we were explaining before, patients have both a deep system and a superficial system, which as Dr. McCarthy explained, are connected by perforators. The superficial system, if it's not working properly and we remove it from the circulation, all of the blood flow is then shunted to the deep circulation, which picks up the slack and will resolve the patient's symptoms.

MARSHALL GOLDIN, M.D.

What is the difference between varicose vein disease, as we're talking about and demonstrating here, and intermittent claudication? Is that a different system?

WALTER McCARTHY, M.D.

Yes, it is a different system. Intermittent claudication is a manifestation of partial blockage in the arterial system. What happens is the patient is exercising and has some partial blockage in the arterial system and the muscle in the calf, typically, starts to have pain because it's not getting enough blood flow. So that's one set of symptoms. The symptoms people have with these varicose veins—the varicose vein symptoms are caused by distension of the veins, so they occur when people are standing and these veins distend and there are stretch receptors in the veins that cause the patient to have burning and itching and aching and so forth. It's really two separate mechanisms caused by blood vessels in the same extremity, but they're quite different.

MARSHALL GOLDIN, M.D.

So, Dr. McCarthy, how do we characterize the difference between the leg discomfort that occurs with vein disease in contrast to the leg discomfort that occurs with artery disease? Could you be more exact?

WALTER McCARTHY, M.D.

The symptoms from the vein disease occur when people are standing or sitting. The pain that people have with arterial disease, with intermittent claudication occurs when they're walking and it occurs right in the back of their calf. Whereas the vein symptoms occur typically over the top of where the varicose veins are. Of course, more severe arterial disease causes pain usually in the person's foot, even when they're not walking. This is actually a fairly big complex.

MARSHALL GOLDIN, M.D.

So what do we do if a patient has claudication of the leg in a circumstance in which the arteries are blocked and last year you took the varicose veins out? How do we treat that patient with arterial disease and claudication of the leg?

WALTER McCARTHY, M.D.

Just repeat the last part of that, Dr. Goldin.

MARSHALL GOLDIN, M.D.

:00 If we have a patient who has had the veins taken because of varicose vein disease such as we've demonstrated here, what do we do next year when that patient presents with intermittent claudication and has a problem and can't walk more than a half or one block at a time?

WALTER McCARTHY, M.D.

If this person was to come back with intermittent claudication, first of all, we'd be able to diagnose that with some Doppler studies to help differentiate her symptoms. We'd be

inclined to open up the arteries, so we'd open up the arteries either using angioplasty or sometimes we use a bypass or sometimes you don't—with intermittent claudication—you really don't have to treat people at all. You get them to exercise and do some other things that increases their range.

MARSHALL GOLDIN, M.D.

I was offline for a moment. Did you say that there are ways to do bypasses even if the veins have been used for another purpose or if they've been removed?

CHAD JACOBS, M.D.

Can you repeat that again, please?

MARSHALL GOLDIN, M.D.

Are there other ways to treat claudication? What I'm asking is, if the veins have been removed and the patient is having significant compromise, other than an exercise program, how would we accomplish a bypass if necessary?

WALTER McCARTHY, M.D.

The initial treatment of intermittent claudication usually involves exercise and getting the patient to stop smoking so that's what we usually do. Then, if the patient would need to have a bypass, as they do in some cases, then we would use the vein from someplace else or use a prosthetic to do it. Scissor.

MARSHALL GOLDIN, M.D.

What is a prosthetic?

CHAD JACOBS, M.D.

There are surgical-grade, man-made materials. We either use Gore-tex, which is polytetrafluoroethylene or we can use woven Dacron, which is a polyester which is woven. These are woven into surgical-grade tubing material, which we can use to perform a bypass when there's no available conduit or no available vein from the patient's own body. Unfortunately the results of those bypasses are not quite as good as when the patient's own material is used. So our preference is always to use the patient's own natural material.

MARSHALL GOLDIN, M.D.

Dr. McCarthy, I see you've closed a few of those little incisions and I can't see them anymore. Can we come down and see if they really are non-visible. I can't even see the suture from this distance.

CHAD JACOBS, M.D.

Just wait 'till you see her in another month.

MARSHALL GOLDIN, M.D.

So you think, Dr. Jacobs, in another month, we'll see nothing?

CHAD JACOBS, M.D.

Yes, that's correct. We're just about finished with both the closure procedure and the stab phlebectomy. Thank you for joining us. Dr. McCarthy, any final comments?

WALTER McCARTHY, M.D.

No, I think we're just about done here. We're going to finish up with this leg and then we're going to do exactly the same thing with the other calf. We'll probably be done in another 20 minutes or so. I'd like to thank everyone for their help and attention.

CHAD JACOBS, M.D.

Dr. Goldin, back to you.

MARSHALL GOLDIN, M.D.

Thank you from all of our staff at Rush University Medical Center. The archive will be available on www.orlive.com later today or tomorrow and will be available for viewing at any time in the future. If any questions arise, feel free to call us at Rush for this procedure.

NARRATOR

01: This has been a live webcast of a VNUS closure procedure for the treatment of varicose veins from Rush University Medical Center in Chicago, Illinois. For more information, to make a referral or make an appointment, click the buttons below.