

[MUSIC PLAYING]

**ULKA SACHDEV:** Good afternoon, everyone. My name is Ulka Sachdev I am one of the vascular surgeons within the Department of Surgery in the division of vascular surgery here in Pittsburgh. I work at McGee Women's Hospital. And today I'm going to be talking about Foam Ablation of Varicose Veins: Why, When, and How.

So why do we do foam ablation? Well, varicose veins is estimated to affect almost 5% of the population. More than 12 million individuals may suffer from disease or issues associated with chronic venous insufficiency. We usually evaluate chronic venous insufficiency and the severity of varicose veins based on the following acronym where we're looking and assessing for heaviness, aching, swelling, throbbing, and itching that can bother patients.

The picture on the right-hand side of the screen demonstrates some of the physical changes we might see with chronic venous insufficiency, including varicosities, which are bulging veins that bulge over the surface of the skin, as well as ulcerations in very severe cases, and chronic edema, which is swelling around the ankle. So the reason that we treat the varicose veins is most of the time these are symptomatic. And patients can suffer from aching pain, fatigue, itching associated with the bulging veins along the surface of the skin.

And traditionally these used to be treated with stab phlebectomies, which are surgical procedures to remove the veins through incisions. But these also can be quite unsightly. Normally when we're treating varicose veins we are treating those veins that are in existence or bulging due to insufficiency or incompetence of the superficial venous system of the leg. And typically these include the great saphenous vein, the small saphenous vein, and the anterior accessory saphenous vein.

So just to go over a little bit of the anatomy, the great saphenous vein drains the blood from the dorsum of the foot. It runs along the medial aspect of the leg and the thigh. And importantly, it is encased in a sheath, which makes it very easy to identify when you're doing percutaneous procedures.

The small saphenous vein runs along the posterolateral aspect of the leg. And it's very close to the sural nerve, which also has some important consequences when we're treating that vein. It has a more variable termination than the great saphenous vein. And usually we'll drain within five centimeters of the popliteal fossa in about 70% of cases. In some instances, the small saphenous vein, we'll drain it directly into the femoral vein, and will drain below the popliteal fossa in about 5% of cases.

Finally, the anterior accessory saphenous vein runs along the anterior lateral aspect of the thigh. It has a variable origin off of the common femoral vein or off of the proximal great saphenous vein. It runs in an anterior aspect of the thigh, and also within its own sheath.

And at some point it branches, and this is usually in the mid-thigh. It may have a five to 25 centimeters segment of straight length from the saphenofemoral junction to this branch point, which makes it amenable to certain types of treatment, particularly endovenous thermal ablation. And it can cause symptoms throughout the leg.

So foam sclerotherapy is one of the options that we have to treat varicose veins. It is a 75-year-old procedure, so it has been in existence for quite some time. Usually this is used to manage refluxing and truncal and varicose tributaries using a mixture of both liquid and gas. And that's kind of how the treatment works. It was first described in 1939, when the sclerosant that was used to get rid of varicose veins was found to form bubbles when you shake-- could shake it with air. And this was called shaking the vial technique.

There were other techniques described where an air block would be used to displace the blood within the vein before the sclerosant was placed. And the main idea was to prevent dilution of the sclerosant within the blood to get a good apposition with the vein wall and cause the desired sclerosing effect. Since the 1930s, there have been modifications to the techniques over time. And you can see that by the late-- by 2000 there had been a lot of additions and different modifications to the procedure to make it more effective and to make it safer.

The theory and the reason that this works is that the foam mixture that's created increases the surface area of the sclerosant, which it allows it to get in to contact with the vein wall for more of a distance. And the smaller the air bubbles that are used, the greater the surface area of the foam sclerosant. The liquid agents that can be used as sclerosants include ethanolamine, sodium tetradecyl sulfate, as well as polidocanol, which is what we use in our practice. And then any of these sclerosants can be mixed with different types of gaseous agents, including room air, which is what I will be showing a little later in a video, as well as CO<sub>2</sub> and some combination of both oxygen and CO<sub>2</sub>.

There are pros and cons to each type of techniques. And probably the most straightforward and certainly the cheapest way is to mix the sclerosant with air. Once the foam sclerosant is inside the vein, it does a couple of things. It induces vasospasm and it displaces the blood. It damages the endothelium, which is what results in the final efficacy of the product and the technique.

There's a lot of benefits associated with foam sclerotherapy, the first and foremost being that it's really quick. It takes about five minutes to do. It's ambulatory, so patients can come to the clinic and get it done and then leave and go back to their normal activity.

There is minimal discomfort, although some people are a little bit more uncomfortable with the procedure than others. It avoids scarring that could be associated with surgical treatments. And it's very effective for tributaries of the saphenous system.

There are some downsides, however, and these are highlighted in red. This includes pigmentation. And the pigmentation happens for a number of reasons.

One of them is that if the sclerosant is injected at a higher pressure, it can actually cause extravasation of red blood cells out of the vein wall. And when that happens, the red blood cells break down within the skin and you get hemosiderin deposition along the pathway of the vein. And in most cases that will go away, but there are rare circumstances in which that staining can be permanent. So that can be quite unsightly and certainly annoying to patients.

Immediately after the foam sclerotherapy, patients can suffer from a phlebitic type reaction, which can be uncomfortable. And that is usually something that goes away within a couple of weeks. But again, that's something that can last for a longer period of time. And that can be quite uncomfortable for patients.

In very rare circumstances, you can get ulcerations from the injection site as well as DVTs, which is reported in less than 1% to 1.5% of cases. When it does happen, it a lot of times will occur in muscular veins, deep veins. Some people will report visual disturbances, and it's not really clear why that happens. It's been thought that maybe the visual disturbances are due to a patent foramen ovale in the heart, but that hasn't really been proven. People who have a history of migraines may experience more visual disturbances associated with the foam sclerotherapy. And in very rare circumstances, people can get an anaphylactic reaction.

So when do we opt to use foam sclerotherapy? And well, we use it usually when we're treating varicose veins after the axial refluxing vein is ablated. So typically we would be doing this after a person has undergone an endovenous ablation of the saphenous system, either the great saphenous, anterior accessory, or the small saphenous vein.

And different reports will describe different success rates. One of the better ones is about 80% success rate of permanent closure at three years. After the management of axial reflux, again you can see the numbers on the success rates are actually quite good when you're looking out to three years. Although more recent data suggests that foam sclerotherapy is probably not as effective for the great saphenous vein, there are a couple of studies that have looked at how well foam ablation works in the great saphenous system as compared to a traditional stripping or to an endovenous laser ablation. And it's found that the recurrence rate of-- or the recurrence rate is much higher in the foam sclerotherapy group.

Foam sclerotherapy can also be used for the chemical ablation of perforators in the setting of more severe venous disease associated with skin changes. So that would be either edema, healed ulcers, or active ulcers, as would be designated by the C4 through 6 classifications. And foam sclerotherapy is really a good treatment option for those remnant veins that open again after an ablation has failed.

So how do we treat the veins? Well, we can treat veins that measure anywhere from three to 12 millimeters, although there are some reports that you can treat veins up to 15 millimeters. We use a Tessari technique in which we mix air of a certain volume to a certain volume of fluid.

This is done by using two five-milliliter syringes and a stopcock. We use detergent sclerosants. So this polidocanol, or STS.

And we mix one ml of the sclerosant with four mls of air. And we mix about 20 times so that we are ensuring that we're getting really small air bubbles. We don't want big air bubbles. And the stability is only for about two to three minutes, so it is suggested to get access into the vein first, then mix the sclerosant into the foam, and inject the foam right away. Otherwise it will degrade, and you'll end up injecting too much air into the vein, which is dangerous.

So generally speaking, we will use a butterfly needle. And we use ultrasound for positioning of the needle and foam manipulation once it's in there. We also use the ultrasound to compress the deep system so that-- or the entrance of the superficial system into the system, or those perforators, to prevent the foam from getting into the deep system in massive quantities. You want to do the injection ideally with the leg elevated. And you want to apply immediate post-treatment compression to get a good result.

So this is a step-by-step guide that's published about how to do the procedure. And to grow through it, once again we would map and draw the venous network on the skin. You don't necessarily have to draw it, but you can use the ultrasound.

You want to prepare the skin. And in our case, we use an alcohol swab. We place the needle into the vein under the duplex guidance. And we keep the needle beveled down. So you really want to ensure that the needle is inside the vein and that you get good blood return.

And then you prepare the foam. So in this particular description there, they describe using three mls of the air, but we use four. And then once you are confirmed that the needle is inside the vein, you can inject. And you inject slowly at first, and you verify that the bubbles are indeed inside the vein and not extravasating outside of the vessel.

You inject progressively but not too forcefully. Because again, if you inject too forcefully, the risk of getting hyperpigmentation associated with that high pressure injection increases. You want to make sure that there is the induction of venospasm, which you usually are able to tell using the ultrasound.

And then you remove the needle and place a ball of cotton or some type of compression over the injection site. We apply a rubber foam pad or some type of either an ACE bandage, or ideally you have a person put their compression stocking on right away. You have them sleep with that overnight. For the next day, they can take it off, take their shower, and then start wearing the compression every day for at least one week. And then have them follow up in about one to two weeks.

So there are actually some consensus recommendations that have been established to increase the safety and efficacy of foam sclerotherapy. You want to vary the concentration of the sclerosant that you're using with the vein type. So for example, if you're going to be doing sclerotherapy, and you can do foam sclerotherapy for spider veins, but you have to really make sure you're using a very low concentration of the sclerosant, because otherwise hyperpigmentation can be a real risk.

You don't want to inject any more than 10 mls of foam at a given session. And this will help assure that the risks associated particularly with the visual disturbances and the DVT are minimized. And you don't want to do this on a patient who you know has a symptomatic patent foramen ovale.

You want to avoid direct injection of perforators rather inject the superficial system and you can milk the foam into the perforators. And you want to make sure you're compressing post-treatment. And these again will help reduce complications associated with the procedure and will help increase the efficacy.

So we have compiled a video to describe how we perform foam sclerotherapy in our clinic. This is at McGee Women's Hospital. And we perform the procedures inside the ultrasound room where the duplexes are performed.

This is a box that we have pre-made, where all of the items and ingredients that we might need to perform the procedure are contained in one place. This includes the sclera in one cc aliquots as well as extra syringes to mix with air. We have a stopcock, alcohol pads, and the butterfly needle.

So when we're preparing the foam, and again this would be done once access has been safely established in the vein, we use-- we connect the two syringes, one filled with air and one with the sclera to a stopcock. And then this, these two syringes gets mixed to create the foam. And the mixing should occur for about 20 seconds, or about 20 times. And again, that's to ensure that the air bubbles are really small. And then once it's made, you would inject it right away.

And this is a video showing the needle placement into the vein and injection of the foam into the vein. And that's it. It's a very simple procedure.

Once that's done, the leg gets wrapped and the patient can go. So the patient, either the leg gets wrapped, or the patient wears their compression stocking and they're able to go home that day. You do want to encourage patients to walk around that day. And this would be true for any venous procedure, that you want to make sure that the patients are ambulatory, because that helps reduce the risks of DVT, which can be associated really with any venous procedure.

So this is just some data describing the efficacy of sclerotherapy. And this is particularly focusing on the use of this particular treatment for the great saphenous system. This is a randomized trial that's comparing different treatments for varicose veins.

They compared proximal ligation of the saphenous vein with stripping foam sclerotherapy with STS, using either 1% or 3% formulations and laser ablation. And they looked at a number of different outcome measures, the clinical success at the time of the procedure, and how persistent was the ablation, what was the persistence of varicose veins, and what were the severity scores of patient's symptoms. They also looked at quality of life measures.

The results were interesting. They showed that there were similar improvements in venous clinical severity scores with the three treatments. There was a slightly worse disease specific quality of life with foam at six months. And there was less complete ablation with foam than with surgery or laser ablation in the long term. So 55% with the foam compared to 84% and 83% with surgery and laser ablation respectively. So again, emphasizing that the foam had a little less of the efficacy when it was used in the great saphenous system.

So to conclude, foam sclerotherapy is easy to perform. It's safe and effective. And it's particularly useful for tributaries of major axial reflux. So if you're looking to treat tributaries of the great saphenous vein, small saphenous vein, and the anterior accessory, you would want to do that sclerotherapy after those treat those other veins have been treated.

The treatment of the great saphenous vein with a physician-compounded foam, which is what we're doing in our clinic, may offer inferior long-term results than any venous ablation. However, this may change with newer formulations. And there are products out there that are being tested in this application.

You want to make sure you tailor the concentration and the volume of the sclerosant to the size of the vein, and limit the volume to 10 mls per session. This would usually mean 1% for great saphenous vein, main tributaries, small saphenous vein, and anterior accessory saphenous vein. And that's if-- with the caveat that generally speaking we wouldn't use foam sclerotherapy for the great saphenous vein, small saphenous, or anterior accessory except if for one reason or the other those particular veins were not amenable to endovenous ablation.

And then you want to use 0.5% for smaller or very superficial veins to help limit pigmentation. And remember that when you're injecting, don't inject under high pressure. You want to counsel patients that treatment may require multiple sessions, even over a lifetime.

And I always set up that expectation in the beginning when I'm first doing my first consultation with a patient, that varicose veins do tend to come back, and that any treatments are likely to be temporary. They might expect to have to undergo procedures over their life. So thank you very much for your attention, and I'm happy to take any questions.