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DEEPAK SUDHEENDRA: Hello, my name is Dr. Deepak Sudheendra, and I am a vascular interventional radiologist here at the University of Pennsylvania Perelman School of Medicine. Today I would like to talk to you about the management of acute and chronic deep vein thrombosis and post thrombotic syndrome.

As you know, close to 600,000 patients per year are affected with deep vein thrombosis. And the vast majority of patients who present with deep vein thrombosis are generally treated according to the standard of care, which is blood thinning medication or anticoagulation. However, for anywhere between 25 to 50% of patients can present with long term complications of deep vein thrombosis. And those complications include symptoms such as chronic leg swelling, fatigue, heaviness, varicose veins, skin ulcers, and skin changes. Collectively, these symptoms are known as post-thrombotic syndrome.

The mainstay for deep vein thrombosis remains anticoagulation. And the vast majority of patients will be treated in this manner. However, for patients who have extensive DVT, and by extensive I mean thrombus that involves the iliac vein, the femoral vein, and in some cases the entire superficial femoral vein, a more aggressive approach can be done to prevent the subsequent development of post-thrombotic syndrome.

Patients that present with acute DVT-- and that is DVT that is seven to 14 days old-- are considered for DVT thrombolysis. Now DVT thrombolysis has changed over the past several years. Many of us recall patients undergoing DVT thrombolysis that involved two to three days of lytic therapy. And during that time there was always a concern for significant bleeding that could occur anywhere in the body.

But as interventional radiology has advanced, as our techniques have advanced, the amount of thrombolytic agent that we have to use has significantly decreased. So for example, within 24 to 48 hours of developing a deep vein thrombosis, a patient could undergo what we now call pharmacomechanical DVT thrombectomy with a minimal amount of lytic agent. And as result of that, the chance of a bleeding complication has significantly been reduced.

As I mentioned, pharmacomechanical thrombectomy has really changed the amount of lytic therapy that is needed to treat a patient who presents with DVT. The main lytic agent that we tend to use is tPA. And tPA, as you know, is a very powerful clot busting medication. Fortunately, it has a half life of about six to eight minutes, so it really doesn't last that long in the body. But even that six to eight minutes can be enough to cause significant hemorrhage within the body. And that is one of the reasons that many physicians have sometimes been reluctant to send a patient for DVT thrombolysis.

Before pharmacomechanical thrombectomy came about, catheter directed thrombectomy involved putting a catheter in the affected vein and dripping tPA over 24, 48, and sometimes 72 hours, at a rate of a milligram an hour. So this resulted in a patient getting anywhere from say 24 to 72 milligrams of tPA, which is a large amount of tPA. And during that few days, there was a risk of bleeding anywhere in the body. Now with pharmacomechanical thrombectomy, the amount of tPA is significantly reduced.

When a patient presents with acute DVT, and as I mentioned, the sooner we get the patient the better. So if we get a patient who presents with 24 to 48 hours of leg swelling and has significant deep vein thrombosis, we can generally get away with using anywhere from about 6 to 10 milligrams of tPA in order to clear that clot.

This is an example of what we call pharmacomechanical DVT thrombectomy. Rather than just dripping a clot busting medication into the vein, a catheter is placed throughout the entire blood clot, and a strong lytic agent is instilled under high pressure. After that lytic agent sits there for about 15 to 20 minutes, it is sucked into the catheter. And because the clot is soft, we're able to get the vast majority of thrombus out of the deep venous system.

Pharmacomechanical thrombectomy is really ideal for this patient who has acute DVT. And while acute DVT, as I mentioned, is defined as DVT within seven to 14 days, the sooner a patient presents to our interventional radiology department the more likely we can get nearly all of the thrombus out of the deep venous system. So the main message is the sooner someone can get a procedure such as this done, the more likely they are to benefit from the procedure.

Now what do we do for patients who have subacute deep vein thrombosis or chronic deep vein thrombosis that has been going on for five, ten or 15 years? Here at Penn Medicine we have been more aggressive in treating patients with subacute and chronic deep vein thrombosis. Patients who have had deep vein thrombosis for five, ten, or 15 years and who have been suffering from constant leg swelling, fatigue, pain, and ulcers, and sometimes have had difficulty ambulating and are wheelchair bound have been able to come and meet our multidisciplinary team to help deal with their post thrombotic complications.

For example, I have here a case of a 54-year-old female who presented with pheochromocytoma and a left lower extremity DVT that was about a month old. Over the course of that month, this patient's leg was worsening. And to the point where there was concern as to whether she was going to lose viability of her leg. Fortunately, her leg was not in extreme danger, but you can see in the pictures that she was really starting to develop an infection of the left lower extremity. So although this clot was about three to four weeks in age, we were able to take this patient and do the pharmacomechanical thrombectomy.

For those of you who may not be familiar with seeing an angiogram, the patient here is actually laying on her stomach in the prone position. And we've actually placed a catheter in the back of the knee and the popliteal vein. You can see there is a wire that is going up the leg in the superficial femoral vein and there is an adjacent vein next to it, which is actually a collateral vein. As we go near the hip region and into the pelvis, you can see that there is really a lot of collateral veins. There is not one particular vein that can be outlined such as a femoral vein or an iliac vein.

Looking further into the pelvis, we can see the contrast going into the pelvis and really not going much, much farther than that. We can see that the inferior vena cava is not being visualized well here. And this is because of the extent of deep vein thrombosis in this patient.

Here, this is one of the pharmacomechanical devices that we use to remove a clot, which is known as the Tretricola device. We followed this with balloon angioplasty to really open up the veins, because the veins have, over the course of three to four weeks, have started to get scarred from the inflammation of the clot that is sitting there. After balloon angioplasty we put stents into the veins to really keep them open. And as you can see now, there is one continuous vein going in the pelvis. We can see the iliac vein draining into the vena cava.

What sort of outcome does this have on a patient? Well, you can see here that within a month her symptoms and her physical examination had significantly improved. She continued on anticoagulation as well as wearing a compression stocking. And the combination of those two therapies really resulted in her having a wonderful outcome, and really being close to normal.

Now in our next case, this case it involves a 34-year-old female. She was three weeks postpartum, and presented with pain, swelling, and a palpable cord along the knee of her left lower extremity. This was in August of 2014. She reported to a local emergency room in Dallas, Texas and had an ultrasound which showed clot in the greater saphenous vein, extending from the calf to just above the knee.

So as you can surmise, she was diagnosed with superficial thrombophlebitis. Now as we all know, management of superficial thrombophlebitis has really involved NSAID therapy and warm compresses. And that is exactly the treatment that this patient received.

However, superficial thrombophlebitis can extend to DVT in up to 15% of patients. And in this particular patient, because the superficial thrombophlebitis extended for greater than five centimeters and extended into her thigh, within 24 hours she presented with shortness of breath and was found to have bilateral pulmonary embolism. She was also found to have extensive DVT involving the left iliac veins, the common femoral vein, superficial femoral vein, and the calf veins.

At that local hospital she underwent an unsuccessful DVT thrombolysis, and was subsequently informed by her physicians the nothing further could be done, that her running days were over, because she was an avid marathon runner, and that she needed to wear stockings for life, and in addition, be on anticoagulation for life. And she sought a second opinion here at Penn Medicine.

When we saw this patient, we found that her symptoms now had been going on for several months. So she was actually not in the acute phase of DVT any longer, she was more in the chronic phase. What we were able to find out is that this particular patient suffered from a medical condition known as May-Thurner Syndrome.

This is a condition that can easily be treated, but the treatment does not involve lifelong anticoagulation. The mainstay of therapy in these cases is balloon angioplasty, and many times stenting of the iliac vein. What May-Thurner really involves is compression of the left common iliac vein. As you can see in this image, the right common iliac artery, the way it sits in front of the left common iliac vein in women can lead to compression of the iliac vein. And when that iliac vein becomes blocked with thrombus, that thrombus can extend down the entirety of the leg.

What happened in this particular patient is that she developed thrombophlebitis in the saphenous vein which joins the femoral vein. And because she did not have a healthy outflow to this particular vein, her venous system was really burdened with pressure, so to speak. And so she had clot that extended into the femoral vein.

So she came here to interventional radiology. We placed her in the prone position and we placed a catheter in her popliteal vein. As you can see in this first image, there are several collateral veins going all the way up the leg. You can see that there's really no contrast going in the pelvis at all. We do see some contrast in the inferior vena cava. So we do know by this venogram that the inferior vena cava is open, but that the rest of the veins below the vena cava are closed in the left lower extremity.

In this case, we were able to get through all of her blockages and do aggressive balloon angioplasty and stenting. And now, if I were to ask you to take a marker and pick out one vein that drains her entire leg you would be able to do that. And you can see here we have a stent in her iliac vein. This is her femoral vein and her superficial femoral vein going down to her popliteal vein. And she has continuous flow now throughout her left lower extremity.

Within five days of the procedure she had already flown home back to Texas. And you can see that her left leg swelling has completely resolved within a matter of days, and is the same size as the right lower extremity. Within six weeks, all of the skin changes had started to disappear, and the ankle swelling had also resolved.

This patient was discharged on anticoagulation with Coumadin and aspirin therapy. And this is a therapy that she will generally have to continue for three to six months. And after that, the anticoagulation can generally be stopped, unless the patient, of course, develops a new DVT or is found to have a hypercoagulable condition. But in this particular patient, she will most likely come off of her anticoagulation after three to six months, and will not need any further anticoagulation. She'll remain on a baby aspirin daily.