TENG C. LEE, MD: Welcome to University of Maryland Medical Center. I'm Teng Lee, one of the cardiac surgeons here at the University specializing in aortic surgery. Today we're going to be doing an aortic arched debranching combined with endovascular procedure to treat an aneurysm.

Today with me is my team. This is Mark Givers, who is one of the residents. We have Seema Deshpande from cardiac anesthesia. And we have Corinna Yu from cardiac anesthesia as well.

And we have Bryan Ferguson, who is from the neuromonitoring section. And with him is Kate, his assistant. And here is, John, one of our scrub nurses.

And this Arlene, one of our circulators. So we have a good the combined team that do all these surgery. We always use pretty much the same team members.

We're making an incision here to enter the chest. Mat it down. So now we have the chest open.

We're trying to dissect out the major vessels, so we can do our surgery. This is the heart. The ascending aorta comes out onto innominate artery. And then this is the left common carotid that comes off the common trunk. This is actually a variant. This is called a bovine arch.

And I will try to dissect around, get the vessels free so we can proceed with our surgery in a little bit. This is the innominate vein coming across.

So this is a custom made graft by Terumo Vascutek company that was designed by Chet Hughes at Duke. Essentially it has two limbs that come off. We use this to anastomose or connect to the left common carotid artery, and this to the innominate artery, or what we call the brachiocephalic artery.

And this is a sight limb that we'll use in a little bit to deploy our stent graft. And this is a radio opaque marker, so we can see it later on the angiogram. I'm going to cut this into size.

All right. OK. So you actually can see the sac where the aneurysm on the backside here. You can see this thing. That's called the aneurysm.

This is the right pulmonary artery. This is the aorta. And this is the aneurysm sitting right here in the arch. And so hopefully we'll cover this up with the stent graft later once we debranch these vessels.

OK, so now we're going to use a partial cross clamp here to isolate this part of the aorta to or anastomosis without having occluding the complete aorta. Eleven blade. Let's take a look at the graft. Let's make sure it's the right size here-- a little bit more.

Just rounding off the edges here. Stitch. Deitrich.

We're performing anastomosis right now, which is using some Prolene sutures. We're starting our anastomosis. This is to connect this bypass graft to the ascending aorta. [INAUDIBLE]. Another one.

We're still completing our anastomosis from the ascending aorta to the graft. So this will provide the blood to the graft and eventually to the head vessels when we do anastomosis, or connection to the carotid and the innominate artery.

These anastomosis tend to bleed a little. Because it's undergoing a lot of high pressure from the heart as the blood comes out. So this has to be airtight.

So now we're completing our anastomosis. And I will be letting go of this clamp in a little bit. Do you have the tonsil?

So now we're releasing this. There will be some bleeding. Now we just have to make sure we can control some of the bleeding.

So now the blood is going into the graft. Eventually we'll hook this up to the carotid and the innominate artery. OK, so now we're going to be trying to squeeze some of the air bubbles out from this graft. A lot of times there is a lot of air bubbles.

And that can potentially cause some stroke. So we try to get all the air bubbles out. So now we're going to try to test clamp this left common carotid, and see whether there are any changes on the EEG and the motor-evoked potential and the [INAUDIBLE] sensor-evoked potential. Do this for about three minutes.

We have the stopwatch on? OK, clamp on. OK, so this is a 77-year-old gentleman, actually with multiple medical problems, including coronary artery disease, with a stint in his coronaries.

Has a long history of smoking. Has bad lungs. Actually presented to an outside hospital with shortness of breath. And they are working him out for COPD exacerbation. But they got a CT scan of the chest, and found this, actually, incidentally.

So we found this 6.1 centimeter saccular aneurysm right at the arch. And he also has a separate penetrating ulcer at the descending part of the thoracic aorta. So with this procedure with a stent, we'll cover both of the saccular aneurysm and the penetrating ulcer.

So good thing that it was incidentally discovered. Because if this goes on, eventually it will rupture. And he would eventually die from this, if we don't exclude the aneurysm from the blood flow. He also has a history of high blood pressure. So that's the reason that we need to repair this before it ruptures.

OK. And clamp. Brian, any changes on the neuromonitoring? Good. Excellent.

All right. Do you have the stapler? Ready? OK. Pick up.

Now we're going to transect the left common carotid artery, and then connect it to the branch. All right. Angle the brachi.

Scissors-- sharp. Sharp scissors. And start the clock again. Scissors. Yep.

Can I have the suture? So now we're doing this anastomosis of the left common carotid artery. Suck there, please. Suck there, please. Clamp.

Over here. Follow. All right. Cut into it. You can release this clamp, please.

SPEAKER 1: Release this one?

TENG C. LEE, MD: Yeah.

Scissor cut, please. OK, carotid open. Yep.

Now we're going to proceed to doing the anastomosis is from the graft to the innominate artery, which is here, or called the brachiocephalic artery. All right. Now we're proceeding to do anastomosis from the graft to the innominate artery.

First I'm going to do a test clamp, like I did on the carotid. So a test clamp for three minutes. Clamp on. Start timer. Brian, I'm clamp on the right.

This is to test where-- to see whether the brain has any changes. A lot of times, dependent on the collateral blood flow from the other side, if there are changes, which means that the collateral blood supply is not good enough. Sometimes we can increase the blood pressure. And that will help reverse those changes.

Sometimes the patient just can't tolerate it. And we might have to do side-biting clamp, or do a different way of doing this anastomosis. So once we have confirmed that we're OK, the patient can tolerate this, which means that later when I actually do the connection, the patient can tolerate it, which is a much longer period of time.

So now I'm going to transect the innominate artery with this stapler. Watch the back. Make sure we're OK. Scissors. Suction, please.

All right, angle the brachi clamp. I got it. Scissors, please. Another cross clamp [INAUDIBLE]. Heavy scissors.

Straight. All right. Give me the suture.

SPEAKER 1: Which one?

TENG C. LEE, MD: Five-oh.

Now we're in doing our anastomosis to the innominate artery. Let go of this. Clamp back. We're trying to finish up this anastomosis.

We're just doing some of the airing maneuver, getting all the air out of the graft, so that the air doesn't go to the brain, which is critical. Sometimes it might be some air caught in this graft. [INAUDIBLE].

Probably a couple hundred milliliters. It seems like there's a lot. We're using a cell saver, which means that a lot of the blood that's lost here, we can recuperate and transfuse back to the patient.

So I'm just going to use this needle to do some de-airing. Sometimes there are some air bubbles that's trapped under the surface on the very top. Air travels to the top. And I'm just going to get it out. Again, preventing air going to the head is very important.

And these little holes will seal. Because these kind of grafts are especially made of a gel-like material that will close on its own. Most of the time you can see as you withdraw you don't see any more air bubbles coming out. That usually tells me that there's probably not much air out.

Let's do a little bit more. Sometimes you can see. If there's a lot of air you can see on the graft surface itself. But most of the air is already out from the previous de-airing maneuver. This is just extra.

So as you can see, now we have finished our debranching portion of the operation. The aorta is connected to this graft, which supplies the blood to the innominate artery, or the brachiocephalic artery. And then this to the left common carotid artery.

The branches here are transected. So all the blood to the head is coming from this graft. So now the aneurysm which was here, we can cover it with a stent graft in a few seconds here. All right.

So now we have finished debranching part in the arch. So now we're going to get access in the groin to get a picto catheter so we can shoot a contrast injection now. So we can get a camera here.

All right. So camera on here. Give me the micropuncture.

So we're entering the common femoral artery with this micropuncture needle. We're putting this micropuncture catheter in to provide access to the artery. We're exchanging this to put in a 5 French sheath.

We're putting a wire up into the aortic arch. Give me that [INAUDIBLE]. So now we're putting in the stent graft to get it into position.

All right. So now we're deploying stent graft. The stent graft is in position. And we're slowly deploying it. Watch there.

Perfect. All right. You caught that? Good. OK.

Now we're pulling the device sheath back. The device has been deployed, as you can see on the screen. The first piece of the device has been deployed. It's in perfect position. Now we're just going to take out the device that was used to deploy that piece of stenth graft.

Watch it. It might bleed. All right. All right, take it out.

Yeah, that's 34. Yeah, 34. Yep.

OK. We're putting in the second piece device here. All right. OK, slowly. Slowly let it go.

Perfect. You can shoot the flouro. Off on camera one, and then on on camera two. We're just slowly advancing the second piece stent graft in to the first piece.

OK, camera off. All right. Let's see.

Hold on. We're the deploying the second stent graft. Perfect. All right.

Now we're putting the third stent in. Wow. Right there.

All right. Very good. We're going to balloon this stent graft so that it opens up fully. Make sure that it is fully opened. And have a seal on the aorta.

You see that thing there is a balloon. OK. Very good.

Let's do the same thing here, again. The stent graft is in position. And we're slowly deploying it. Watch there. OK.

Perfect. All right. You caught that? Good.

Now we're going to pull this back. Hold the wire. Oh. Now we're pulling the device sheath back. The device has been deployed.

As you can see on the screen, the first piece of the device has been deployed. It's in perfect position. Now we're just going to take out the device that was used to deploy that piece of stent graft. Watch it. It might bleed.

All right. Take it out. Yeah, that's 34. Yeah, 34.

Yep. OK. We're putting in the second piece device here.

All right. OK. Slowly.

Slowly let go. Perfect. We're just slowly advancing the second piece stent graft in to the first piece. We are deploying the second stent graft.

Perfect. All right.

SPEAKER 1: That's really nice.

TENG C. LEE, MD: Yeah.

SPEAKER 1: We just want to maintain-- we want to make sure these dots come because we're minimal overlap over here.

TENG C. LEE, MD: OK.

SPEAKER 1: So I'd keep that--

TENG C. LEE, MD: Now we're putting the third stent in. Wow. Right there.

All right. Very good. OK.

We're going to balloon this stent graft so that it opens up fully. Make sure that it is fully open. And have a seal on the aorta.

You see that thing here is a balloon. OK. Very good. Let's do the same thing here again.

Excellent. All right. OK.

So what you're seeing on the monitor, at least the neuromonitoring shows that everything is back to baseline. There are no changes at all. There are no changes in motor-evoked potential, sensory-evoked potential, or EEG.

So we're pretty happy that after the stent graft coverage and the carotid clamping, there seem to be no physiologic changes from a neuro standpoint. And the reason we do that so we can do some maneuvers in the operating room if we do see changes, and potentially do adjunct procedure.

But everything looks to be in perfect order right now. So I think we'll proceed with closing the chest. So now we have the bypass graft here, still going from ascending to the carotid and the innominate artery. And this is the side branch that we used to deploy our stent graft, this thing.

Now we're going to eliminate this from the system. We're going to staple this across. And that's it.

So now we're back to normal-- not quite normal anatomy. So all the vessels are coming from here. The stent graft is here. The aneurysm is well-covered, as you saw on the screen. Now we just have to control the bleeding, and reverse the heparin with Protamine. And we are good to close the chest.

So today we have pretty much fixed his arch aneurysm and his descending penetrating ulcer with a hybrid approach, which is more invasive compared to what we used to do, which is put a patient on a heart lung machine, stop the heart, and then stop circulation to the rest of the body to do this operation. Although the incision is relatively big, but patients tolerate this very well. And patient generally have a pretty good outcome. And they go home usually within a week.

So the advantage of having this hybrid operating room here is so that we can accomplish this kind of operation, where we actually have to do both open and endovascular. As you can see, we're all in the same room. We're able to use the fixed C-arm which is a very powerful C-arm that we can have good images.

And we can do an open procedure with the nurses here that are capable of doing both. I think with the ability of the whole team approach, with neuromonitoring, with good nursing, and good anesthesia support, I think we can do this very safely. And patients do very well. Thanks again for coming to University of Maryland.