



## Hybrid Arch Debranching

University of Maryland Medical Center

Baltimore, Maryland

February 16, 2012

Welcome to the University of Maryland Medical Center. I am Teng Lee, one of the cardiac surgeons here at the University specializing in aortic surgery. Today we're going to be doing an aortic arch de-branching combined with endovascular procedure to treat an arch 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 Corina Uva from cardiac anesthesia as well. And we have Brian Ferguson, who is from the neuro monitoring section, and with him is Kate, his assistant. And here it's John, one of our scrub nurses. And then this is Arlene, one of our circulators, so we have a good combined team that do all these surgeries. We always use pretty much the same team members.

We're making an incision here to enter the chest. Knife 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 to the nominate artery. And then this is the left common carotid. It comes off a 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 nominate vein coming across.

And so this is a custom made graft by a Terumo Vascutek Company that was designed by Chet Hughes at Duke. It essentially has two limbs that come off. We use this to anastomose or connect to the left common carotid artery and this to the nominate artery or what we call the brachiocephalic artery. And this is a sight limb that we're using a little bit to deploy our stent graft. And this is a radio opaque marker so we can see it later on the angiogram.

Cut this into size. All right. Okay. So you actually can see the sac where the aneurysm on the back side here. You can see this thing. That's part of the aneurysm. The 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 a stent graft later once we de-branch these vessels.

Okay. So now we're going to use a partial cross clamp here to isolate this part of the aorta to do a anastomosis without having occluding the complete aorta. (Inaudible.) Eleven blade. Let's take a look at the graft. Make sure it's the right size here. A little bit more. Punch. Just rounding off the edges here.

(Inaudible.)

Stitch. Deitrich.

(Inaudible.)

We're performing anastomosis right now, so we're just using some Prolene sutures. We're starting anastomosis. This is to connect this bypass graft to the ascending aorta. (Inaudible.) Another one.

(Inaudible.)

OR Live  
unm 3371

We're still completing anastomosis from the ascending aorta to the graft, so this will provide blood to the graft and eventually to the head vessels when we do our anastomosis or connection to the carotid and the nominate artery. This anastomosis tend to bleed a little because it is undergoing a lot of high pressure from the heart as the blood comes out, so this has to be air tight.

So now we're completing our anastomosis, and I will be letting go 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 will hook this up to the carotid and the nominate artery.

Okay. So now we're going to be trying to squeeze some of the air bubbles out from this graft. A lot of time there is a lot of air bubbles, and that can potentially cause some stroke, so we try to get the air bubbles, all the air bubbles out. There.

So now we're going to try to test clamp this left common carotid and see where there are any changes on the EEG and the (inaudible) potential and the (inaudible) potential. We'll do this for about three minutes. We have the stopwatch on. Okay, clamp on. Okay.

So this is a 77-year gentlemen actually with multiple medical problems including coronary disease with a stent in his coronaries. Had a long history of smoking. Had bad lungs. Actually presented to outside hospital with shortness of breath and they're working him up for COPD exacerbation but they got a CT scan of the chest and found this actually incidentally, so we found this 6.1 centimeter sacular aneurysm right at the arch, and he also has a separate penetrating ulcer at the descending part of the aorta, thoracic aorta, so with this procedure where a stent will cover both the sacular aneurysm and the penetrating ulcer. So it's a good thing that it was incidentally discovered because if this goes on, eventually it will rupture and he will 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.

Okay? All right. And clamp.

Brian, any changes on the neuro monitoring? Good. Excellent.

(Inaudible.)

All right. Do you have the stapler ready? Okay.

Pick up.

Now we're going to try to sect the vas common carotid artery and then connect it to the branch. All right. Angle the brachi.

(Inaudible.)

For this (inaudible). (Inaudible) for this. Start the clock again.

(Inaudible.)

Scissors.

(Inaudible.)

Yep.

(Inaudible.)

Have the suture.

(Inaudible.)

So now we're doing anastemosis of the left common carotid artery.

(Inaudible.)

Suck there please. Suck there please. Clamp. Over here. Follow. All right. Cut into. Okay, release this clamp, please.

Release this one?

Yes.

Is it going to go up the other one or –

All right. Scissors cut please. Okay. Carotid open.

(Inaudible) open?

Yeah.

(Inaudible.)

All right. Now we're going to proceed to doing the anastemosis from the graft to the nominate artery, which is here, called the brachiocephalic artery. All right. Now we're proceeding to do anastemosis from the graft to the nominate artery. First I'm going to do a test clamp like I did on the carotid, so I'll test clamp for three minutes. Clamp on. Start timer. Brian, I'm clamp on the right.

(Inaudible.)

Just to test where, just to see where the brain has any changes. Sometimes, a lot of time, we're dependent on the collateral blood flow from the other side. If there are changes then 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 a side-biting clamp or do a different way of doing this anastemosis. So watch and confirm that we're okay and 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.

Okay. So now we're going to transect the nominate artery with the stapler. Watch the back. And so we're okay. (Inaudible.) Scissors. Suction, please. All right, angle the brachi clamp. I've got it. Scissors, please. Okay. Another cross clamp (inaudible). All right. Heavy scissors. Straight.

(Inaudible.)

All right. Give me the suture.

Which one?

Five oh.

Now we're doing anastemosis to the nominate artery. Um hmm. 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 there might be some air caught in this graft. I cannot take.

(Inaudible.)

Probably a couple hundred milliliters. It seems like there is a lot that 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. (Inaudible.) So I'm just going to use this needle to do some de-airing. Sometimes there are some air bubbles that's trapped on 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 specially made of a gel-like material that will close on its own.

While 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 is probably not much air out. Still a little bit. Sometimes you can see, 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 kind of extra.

So as you can see, now we are finished the de-branching portion of the operation. The aorta is connected to this graft, which supplied the blood to the nominate artery or the brachiocephalic artery. And 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're finished the de-branching part in the arch. So now we're going to get access in the groin to get a picco catheter so we can shoot a contrast injection now. So we're going to try to get – we can get a camera here. All right. So camera's on here. Give the micropuncture. So we're entering the femoral artery, 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 the (inaudible) French (inaudible).

(Inaudible.)

One.

We're putting a wire up into aortic arch.

Give me that Branstein (sp).

So now we're putting in the stent graft to get it into position. All right. So now we're deploying the stent graft. The stent graft is in position. And we're slowly deploying it.

(Inaudible.)

Um hmm. Um hmm.

(Inaudible.)

(Inaudible.)

(Inaudible.)

Okay.

(Inaudible.)

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

(Inaudible.)

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 and is 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 might bleed.

(Inaudible.)

All right, take it out.

(Inaudible.)

Yeah. 34.

(Inaudible.)

Yeah, 34.

(Inaudible.)

Yep.

(Inaudible.)

Okay. We're putting in the second piece device here.

(Inaudible.)

All right. Okay. Slowly. Slowly let go. Uh huh. Perfect.

You can shoot the fluoro.

Okay. Off on camera one and then on on camera two. We're just slowly advancing the stent graft, the second piece stent graft, into the first piece.

(Inaudible.)

Okay. Camera off. All right. Let's see. Hold on.

We are 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 open, and has a seal on the aorta. You see that thing there is the balloon. Okay. Very good.

Still the same thing here again.

(Inaudible.)

The stent graft is in position and we're slowly deploying it.

(Inaudible.)

Um hmm. Um hmm.

(Inaudible.)

Was there –

(Inaudible.)

Okay.

(Inaudible.)

Okay. Perfect.

Beautiful.

All right. You caught that? Good. Now we're going to pull this back all the way.

(Inaudible.)

Yeah, 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.

(Inaudible.)

All right. All right, take it out.

(Inaudible.)

Yeah. Thirty-four.

(Inaudible) 34.

Yeah, 34.

(Inaudible.)

Yep.

(Inaudible.)

Okay. We're putting in the second piece device here.

(Inaudible.)

All right. Okay. Slowly. Slowly let go. Uh huh. Perfect. We're just slowly advancing the stent graft, the second piece stent graft into the first piece.

(Inaudible.)

We are deploying the second stent graft.

Perfect. All right.

That's really nice.

Yeah.

So, I mean, we just want to maintain, we want to make sure these dots come down because we're minimal (inaudible.)

Okay.

So I'd keep that

Now we're putting the third stent in.

(Inaudible.)

Wow. Right there.

(Inaudible.)

All right. Very good. Okay. 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 there is a balloon. Okay? very good.

Got to do the same thing here again.

(Inaudible.)

Excellent.

Excellent.

All right. Okay. So what you are seeing on the monitor, at least the neuro monitoring showed that everything is back to baseline, there is no changes at all. there is no changes in the motor (inaudible) potential, sensory (inaudible) 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 is 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 our procedure we're closing the chest.

So now we have the bypass graft here, still going from the ascending to the carotid and the nominate artery. And this is the side branch we used to deploy our stent graft. This thing. Now we're going to eliminate this on the system. We're going to staple this across. And that's it.

So now we're back to normal anatomy – 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 Protomine, and we're going to close the chest.

So today we have pretty much fixed his heart 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

OR Live  
unm 3371

heart-lung machine, stop the heart, and stop circulation to the rest of the body to do this operation. Although the incision is relative big, but patients can tolerate this very well, and patients 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 availability of the whole team approach, with neuro monitoring, 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 the University of Maryland.

Round of applause.

(Inaudible.)