Atherectomy: Treatment for Peripheral Vascular Disease

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Hello and welcome to another OR webcast brought to you by the fine folks here at Halifax Health coming to you live from the world's most famous beach, Daytona Beach, Florida. I'm your host Dr. Scott Klioze. Tonight's show is dedicated to a disease process that's estimated to affect between 8 and 12 million Americans, and is associated with an increased risk of heart attack and stroke. And most importantly, most of these diseases are probably avoidable by simple lifestyle and diet alterations.

I'm joined tonight by my guest host and my guest panel of experts. To my immediate left is Dr. Andrea Klioze. Dr. Klioze is one of our local internists and hospitalists. She is also an advocate for diet and exercise modification to cure most of the disease processes that affect us in older age. And I know this for a fact because she also happens to be my lovely and vivacious wife and the mother of my two children and a bit of a food Nazi to tell you the truth. She won't allow us to have any kind of carbohydrates in the house, but we're going to talk a little bit about that later.

In the main arena tonight we have Dr. John Tonkin. Dr. Tonkin will be our main operator. You can see him on the screen right there. He's originally out of Chicago, did his undergraduate training up in Michigan, and came to Gainesville to do his residency and fellowship under the tutelage of our mentors, Dr. Jim Caridi and Dr. Dick Hawkins.

Standing next to Dr. Tonkin of course is Dr. Dan Miles. And Dr. Miles, also from Florida, originally out of Hastings. He knows how to grow a potato and fix your arteries – great, great stuff. And he also did his undergraduate training at Gainesville, and did his fellowship and residency under the tutelage of Dr. Hawkins and Dr. Caridi.

So with no further ado, let's go ahead and get started. Dr. Tonkin, if you get a moment there, can you tell us about the patient we're going to be seeing tonight and what we plan to do?

I will, Drs. Klioze. Thanks for looking in on us and thanks to all our other viewers. Could I ask you all to elevate my volume for Dr. Klioze just slightly? I ordinarily don't have any problem hearing Dr. Klioze, but I'm struggling a little bit right now. So if you could – great, thank you.

So, Dr. Klioze, we have a 53-year-old patient who has a history of peripheral vascular disease, cardiovascular disease, hypercholesterolemia, diabetes, fairly severe asthma and COPD, who presented to us a little over a month ago with a poorly healing ulceration on her left foot – in fact had osteomyelitis associated with this soft tissue ulceration. And she was worked up with, among other things, a CT arteriogram study which did reveal fairly severe lower extremity peripheral arterial disease, worse on the left than the right.

She underwent a treatment with atherectomy on the left leg about three weeks ago, and since has actually had fairly significant improvement and healing of that left foot. She continues to have claudication on the right – less severe disease but nevertheless needs to be treated from a symptomatic standpoint – and so that's what Dr. Miles and I are going to do for you today.

Excellent, okay, so we're going to go right from the beginning all the way to the end. We're going to see the process from access to closure. And the first thing Dr. Tonkin is going to do is basically get access to the artery. And while he's preparing to do that – we use ultrasound guidance to get access to the artery safely so that we can get in and out – I would like to show a little video just to explain to the audience exactly what an artery is and what a vein is and what the difference between those two vessels are -- so if we could go to the video screen.

All right, I guess we don't have video. All right, I guess we're not going to have that, so we'll go ahead and just look at what Dr. Tonkin is doing in the room right now. If we can fix that video, that would be wonderful – before the broadcast is over.

But for the time being, John, why don't we go ahead and go to the video screen on the ultrasound; and we can actually take a look at what you're looking at.

Absolutely, can you see the ultrasound image we have?

Yes, we can; we've got it up on the screen right now.

If you want to concentrate a little bit, I can describe exactly what you're doing.

Go ahead, Dan.

Basically, the structure we're looking at on the right-hand side of your screen is actually the common femoral artery. He's putting a little pressure down on the artery. You can see it pulsate there. The echogenic or the bright stuff you see in the wall of that area pulsating is actually calcification or peripheral arterial disease within the wall of the artery. In a moment, you're going to see some tenting of the soft tissues around the artery, and that will be the needle that he's going to use to access the artery as it comes down and punctures the anterior wall of the artery.

Let me just point out that the adjacent structure of course then is the vein, as Dr. Miles mentioned. And if I do put some pressure on the saphenous vein and the common femoral vein, which are the two structures more to the left of the screen, if we push on those you can see how they almost completely collapse fairly easily and there is no pulsatility in those structures, unlike the artery. So that's how we recognize and really see the artery very nicely for access. I can magnify just a little bit, and then we're going to go ahead and we're going to – you can see the needle being advanced through the soft tissues.

Okay, so again, you can see the needle and the needle tip there. You can see that deforming the soft tissues superficial to the artery. And as we get right down on top of the artery, I can see that I'm going in single-wall puncture, directly into the top of the vessel.

Okay, give a little jab there and then I have return of bright red arterial blood.

So if we can cut back to Dr. Tonkin there and actually see what his hands are doing. And you can see the blood coming out of the needle so he knows he's in the artery. That is a pulsatile arterial blood. By any chance, do we have the video capability?

What Dr. Tonkin is doing now--

I can see the video image outside the patient.

We're actually watching the patient under live x-ray or fluoroscopy simultaneously while he's doing this. And he's advanced the guide wire now from the common femoral artery in the groin up through the external iliac and into the common iliac artery. And at this point he's passing the sheath into the artery so we can begin to pass some of the tools we're going to use here a bit later to try and open up the blood flow to the right leg.

All right, and my guide wire is actually cooperating very nicely. I'm not going to do that quite yet. I want to take an image of the pelvis here before we actually go up and over and extend down into the right leg. So we're going to put a vascular sheath – a valved sheath – into the artery, and that's a little tool that allows us to smoothly go in and out of the arterial system in an atraumatic fashion with other catheters and wires as needed, and yet of course prevents the blood from spilling back out at us.

Could I have a flush, Dr. Miles?

Sure.

Thank you.

James is loading the diagnostic catheter onto our guide wire, and we're going to manipulate this. This is called an Omni flush catheter. We're going to move that up into the lower most part of the main artery in the abdomen – the abdominal aorta – and we're going to take a quick image of the pelvis just to verify that we haven't seen any changes in the patient's inflow, the delivery of blood to the legs, through the pelvis. And so we're going to center up so that I can see all the way basically down to where we access the vessel. We're going to optimize our imaging setup here. And then we're going to go ahead and do a subtraction arteriogram.

Dr. Klioze, you might want to cover subtraction arteriography while we're doing this; and we'll look at the image.

Absolutely, and as Dr. Tonkin is injecting -- and on the screen what you will see is actually the contrast come into the vessel and pacify the distal aorta and both iliacs -- and just kind of a look to see where the anatomy is, laying out the lay of the land, and preparing to go over and treat the symptomatic leg.

Okay, now I think we do have some video access now. I'd like to go to the video just to explain the difference between an artery and a vein. If we could bring that up, that would be wonderful. All right, and there's the image that you see right before you there. And if you look, we're going to look at this area right here. And what we see is a red vessel and a blue vessel.

By definition, arteries are depicted as red and that's because they carry oxygenated blood. They come from the heart down to the periphery.

Veins on the other hand, which are depicted as blue, are going to carry the blood from the periphery back to the heart.

Because they have different responsibilities, anatomically they are very, very different. Dr. Tonkin was showing you the artery, which is what he was in – and not the vein, which we didn't want to be in. So going through all of that, you can see that the veins are actually valved vessels. The heart's not strong enough to push the blood all the way down to the toes and back up to the heart again, so the valves help with that process. And these are what the veins do to make sure the blood makes it back to the heart.

The arteries on the other hand are muscular tubes, and they can open and close on demand depending on what we're trying to accomplish. If we're walking, that artery will open up, supply more blood to the foot. So this is what the artery and the vein is.

We are now in the artery, and Dr. Tonkin is getting access to go over and treat that vessel.

How are you doing in there Dr. Tonkin? Are you ready to--?

We're actually doing some preliminary picture taking here, Dr. Klioze, which we usually do even if we have good diagnostic information from a prior non-invasive exam like a CT arteriogram. We like to get an updated set of pictures at the time of the procedure, and that's what we're doing right now. We're going to do basically a subtraction arteriogram all the way down the leg just to make sure we have a current set of pictures that we can refer to and also to verify that there haven't been any changes that we need to be aware of. So we're going to do that right now, and you can watch along with us.

I don't know if we can maybe have James or Dr. Miles show those images that we just did while I'm repositioning for this.

Sure, if we can – well, we're back to live.

Let's go over to the run video, not the live video. There you go.

All right, we can talk a little bit about this. This is one of the first images that we took. And what you see there on the right-hand side of your screen is actually the guide wire that we used to gain access to the arterial system so we can pass our sheaths into the arterial system. We've actually moved quite a bit further ahead than that image there. Dr. Tonkin now has already advanced a catheter over the aortic bifurcation, and we're actually looking at the arterial inflow and runoff to the left lower extremity.

Let's go back to left – so live fluoro.

And what you're looking at here, he's got a catheter that now goes from the right groin over to the left common femoral artery, which is the blood supply or the inflow to the left leg. We're looking at three arteries there. The proximal one or the one at the top of the screen is the common femoral artery. Then the longer artery you're looking at is the superficial femoral artery, and then the other one with the branches off it is the deep femoral or profunda femoral artery. And we're doing this to assess the arterial inflow to the leg prior to any intervention. We have had, as Dr. Tonkin described, a CT angiogram done previously; so we know this patient has a pretty good lesion distally, and you can see it there overlying her distal femur just above the level of the knee.

Now, before we go on, I do want to show one more video here if we can flash over to the computer screen and where Dr. Tonkin has accessed that vessel and why it's important to go in where he went in.

That's a good point, Scott. We kind of went pretty briskly across there. But the bottom line is we want to be below the inguinal ligament and access the artery in between basically the inguinal ligament and above the area where the artery on the right is going to bifurcate into the superficial femoral and profunda femoral arteries.

Absolutely, now let me show that with a video if we could. So, we've got our skeleton and our artery. You can see I've gotten rid of the veins now. So basically, all we're looking at is the arteries coming from the heart. And Dr. Tonkin accessed that vessel right down here over the femoral head. And these are the vessels that Dr. Tonkin was talking about. This is the profunda, which is the deep femoral, which goes around the hip. And then the SFA is the one that goes down the leg, and that's what he's looking at right now. So he actually accessed on the other side, came over and is now looking down at the right leg.

And once you get into an artery, no matter where you get into it, you can see that you can actually go almost anywhere in the body. From this access, we can actually go up into the head, into the heart, down each of the legs. So he's gotten in over here on this side, has come up and around going down this vessel, and he's now looking down this leg.

So let's go back to Dr. Tonkin and Dr. Miles and see where they're at.

Scott, we may want to cut the live fluoro if we can.

Okay.

Dr. Tonkin has already advanced his catheter wire from the right side of the patient over to the patient's left. And now what he's doing, if we can look at the live fluoro, he's advancing a guide wire down the patient's left superficial femoral artery; and we'll see it here in a minute. The wire, if you'll notice, has a little curve on the distal end of the wire. And he's using that curve basically to steer the guide wire down the appropriate vessel. He cut back there a little bit from it. But the bottom line is the guide wires we use in a particular case like this are directional. And we use directional wires because you can see from the images, there are turns and curves in the arteries; and we need to be able to navigate through those turns and curves in the arteries.

Absolutely, and that is the key to this procedure for sure. Can we show another video? Do we have time to go back?

Just while we're –

Let me just show real quick, Dr. Tonkin.

Go ahead, Scott.

Okay, so just to describe the process of an atheroma and what we're dealing with, this is an artery. We've seen it before. The outer layer is called the adventitia, which is the layer that holds the whole vessel together. Inside of that is the media. And the media is the muscular layer that allows the vessel to open and close like we showed you previously. This inner layer that you see right in here is called the "intima," which we're going to see momentarily. And the intima is the one-cell-thick layer that basically protects the vessel from injury and harm – all those tender tissues underneath.

What happens because of our diet and our lifestyle is you end up getting trauma to that one-cell-thick layer. It's call an "intimal injury" or "intimal trauma." The body tries to heal that; and when it heals it, it ends up with what we call a "fatty streak." And they've done autopsies on 19-year-olds from earlier wars. And the American lifestyle, the American diet, you start seeing this in the teens. It is a disease process that actually starts right after childhood.

After repeated injuries, you'll end up with a whole bunch of atheroma inside, or injury inside, and that will be the atheromatous plaque that basically narrows that vessel and prevents it from opening and closing. If it gets bad enough, you end up with a thrombus inside the middle; and this is basically when the vessel is completely cut off and you stop the blood supply to whatever it's feeding – hopefully not your heart. Hopefully it's not going to be your brain. But that's what we're dealing with right now.

Dr. Tonkin?

So, Dr. Klioze, what we're going to show you now is a roadmap image of the distal superficial femoral artery that we've made our way part of the way down with our diagnostic catheter. And we're going to go further down. In fact, we're going to go past basically all the disease here and get into the healthy distal popliteal artery, the artery that runs directly behind the knee. And what I'm going to show you is our subtraction capability, which is our road mapping capability, which allows me to see the outline of the vessel in white, having injected dye in there previously. And then of course we can see the guide wire as it moves down through the vessel and out a little branch there. So we don't want to do that.

No pressure – no pressure, Dr. Tonkin.

Yeah, I couldn't get into those if I was trying to.

Yeah, if you were trying to get into those little branches, it would never happen.

But of course the key here is – now, this is not a particularly difficult lesion to cross. But this would allow us to much more easily verify that we're staying in the lumen of the vessel, the main flow channel of the vessel where we want to be, all the way down past the level of disease which we've now done. So we're going to go ahead. At this point, I'm going to take our diagnostic catheter out. We're going to put a larger sheath in that we can actually do some intervention through, specifically the atherectomy.

Good, all right, while you're doing that, I want to go ahead and show another video here. I know we're going back and forth; hopefully, it's not overwhelming. But let's flash over to the screen. And I want to show you. In my opinion, this is probably the most important part of the procedure. This separates the men from the boys, the women from the girls. This is that same image we saw previously where you've got the plaque inside of the vessel, all right, and you've clauded it off.

And as Dr. Tonkin alluded to, this is not a particularly tough case. But in the cases that are more advanced, where you have no vessel there, the key is to stay inside the vessel. And you want to guide that wire and the catheter down the center, and it's called "intraluminal." As that wire comes down the center and you stay right in the middle; that is called an "intraluminal position" of the wire and catheter. And that allows us to do a lot of different things. It keeps doors wide open to basically treat any way we want.

This is the same kind of image that Dr. Tonkin was showing. This is the subtraction image. And we're going to see a wire that's now going to be advanced down the center of that vessel, staying right in the intraluminal. It's absolutely paramount. When you do that, you can go in and you can do a balloon angioplasty, which is when we go in and we put a balloon inside and we open up the vessel. You can do an atherectomy, which we're going to see right here. This is actually shaving the inside of the vessel. This can only be done if you maintain your wire course inside the vessel itself, or you can put a stint.

You have all these options available to you. And like I said before, this is where it's paramount so that you can actually do a lot of different things. You've got to maintain access to that vessel right down the center.

This, on the other hand, is called "subintimal." And you see the wire is actually coming below the lumen and in that muscular layer. And the problem is in the subintimal course, you don't really have too much choice. At that

point, you can't do atherectomy. You can't do balloon angioplasty. You're basically limited to stenting. You have to put a stent in because the other treatments are not going to work.

So you can see we're back with Dr. Tonkin now. He's putting his sheath in, and he is getting ready to do some treatment here.

How are you guys doing?

Well, we have the treatment sheath now, Dr. Klioze, all the way over into the contralateral common femoral -- so basically at the level of the groin. You can see the little marker tip on the end of our sheath there. We're going to leave that just above the superficial femoral. And we're going to put a distal protection filter, which is just sort of like a little windsock made of mesh metal. We're going to deploy that down into the popliteal artery here, kind of below the level that we're treating. And the purpose of that will be to catch any debris that might otherwise embolize to the foot during the course of our procedure.

So again, I'm going to get us a subtraction image here – a roadmap image rather – so that we can sort of get the lay of the land. There we go. And we'll take a 5mm SpideRX filter, please. We're going to get this –

Dan, let me run this wire down just a tiny bit further there.

John, while you do that, let me just show graphically what's going on if that's okay.

Sure, go ahead.

All right, so let's come on back to the computer screen here; and what Dr. Tonkin is talking about is that distal protection device. And this is what that looks like. He's going to get the wire down, and he's going to deploy this basket. And you see how that basket opens up inside of the vessel. And this is going to be a net. As we treat the patient, we want to make sure that none of that debris goes flying south and actually lodges in the small vessels of the toes because then they turn black and fall off and that's probably bad form. So he's getting that down right now.

I just want to remind everyone that if you have any questions – we're already receiving some – you can click on the little link right there on your web page. You can ask a question and you can submit that question. There are no stupid questions. We're happy to take anything that you guys have. If you want to put your name on it, I'll be happy to read it right here on the World Wide Web; and we can address those as they come up.

We've already got a couple right here. I'm going to pass one off to Dr. Klioze here, and she can ask the question to either Dr. Miles or Dr. Tonkin.

So Jane from Orlando, she was asking, "What were the symptoms this patient was having to have this procedure?"

While John's working here – he's at a point that he's trying to cross this lesion – two things. First, she developed a large ulceration on the right leg, as we talked about earlier, which first we fixed the right leg. We predominantly healed this ulceration. But after we fixed the right leg, then the patient noticed she could only walk about 100 yards or so before her left calf started hurting. It basically felt like her leg was cramping up or her calf was in a vise and pressing down. She would walk about 100 yards; she would have to stop, rest, the pain would go away, and then she could continue walking after that. Basically, she was having symptoms of claudication on the left.

From that point, she underwent a simple blood pressure test, called an ankle-brachial indices, or ABIs, which showed significantly diminished blood flow at the level of the left calf. From there she underwent a CT angiogram that documented the lesion in her distal left superficial femoral artery. And subsequently, she arrived here; and we're going to fix this lesion hopefully in a few minutes.

You know, it's not unusual -- we fix one of the symptomatic lesions that is worse on one side or the other. Then you unmask the problem on the relatively asymptomatic side. So we see this fairly frequently. It is a systemic disease, and we're going to talk about that momentarily.

But how are you doing there, Dr. Tonkin? Are you ready to show us something?

We're coming down our catheter now, Dr. Klioze, with the Spider filter; and that has markers on it to show you the portion. And you can just see it spring out into the vessel there. And it looks exactly like – basically, you can see it's basically a windsock made of mesh metal with markers on the front. And then the tip -- here's a little bit of the wire that sticks out the end of that. And we've got that in the popliteal below the knee joint level, so that's below the level we're going to treat and above the level of the branch vessels in the calf. So really by putting that in place there, we've protected the foot and the distal muscles of the calf from any debris that might break off during the course of the procedure. So that's in good position now.

Okay, guys, just to get the audience on board here, can we go back to that live fluoro image that you had? And you can see that that is the SpideRX that's deployed. We're right below the knee joint, and that is just below – you can see the knee right there, the joint. And we're in the popliteal artery. The area that we're going to be treating, you can actually see. If we can flash over here momentarily to the computer, I'll show you where we actually are.

If we come on down the leg -- this is going to be the other leg, but it still shows you what we need to see – this is going to be the SFA, which Dr. Tonkin has traversed. And we're actually down in this area right here below the knee. And you can see the vessel actually passes behind the leg. So if we make the bone invisible, it actually passes behind the bone. The lesion that we're talking about is up in this area right here. So Dr. Tonkin just deployed his SpideRX basket right here below the knee, below the area of disease; and that's where we're at right now.

How are we doing there, guys? We're back on your live fluoro.

This is the live fluoro image. And John is just getting everything set up here. We noticed a little bit of disease on her CT angiogram at her proximal superficial femoral artery. So he just wanted to take some oblique images of it and make sure there wasn't a vessel overlap and we're missing some significant disease up higher.

Can you see our runoff image here, Dr. Klioze?

I see your runoff image right now – yes I do.

What I think we're going to start with is we're going to begin – generally the rule of thumb is that you begin treating proximal disease and then you progress downstream. And although there isn't any critical narrowing in this area, there is some disease in there. We know it to be fairly concentric, meaning likely to be physiologically significant based on the CTA. So I think we're going to make some cuts through this proximal area, and then we'll go down and get that more severe lesion just above the knee joint. But we're going to focus right here on this proximal disease. So I'm going to do some magnification views so we can get a nice mask. And then we'll be proceeding with the atherectomy in just a second.

Okay, John, while you do that, I'm going to go ahead and answer a question here. Dr. Andrea is going to read that for us.

So Gerald from Lake City asks, "How long does this procedure normally take?"

Well, that depends a lot on the severity of disease. For example, her contralateral leg had very severe disease. She had a complete occlusion of the vessel -- not just areas of stenosis or narrowing, but a total occlusion of the vessel over a fairly long length. When you're dealing with that, it can take quite a while to resolve that.

But we've selected an easier lesion this time because we know we want to get this done in an hour. We're going to show examples of the other side. We do have pictures, but we couldn't – that was like a two and a half hour case. So we couldn't do that in the time allotted. So we elected to do the easier case for demonstration purposes.

Let's go back to the video that you were just showing momentarily, and we're going to answer another question here. Mary Ellen, I think, asked a question.

She had a great question. She actually asked, "Is this usually the legs that it affects?"

Okay, and that is a fantastic question. Let's go back to the video, and I'm going to show you. This is actually a systemic disease. And the problem is, if you look here, the heart sits in the middle of the chest, provides all these

vessels with blood. So if you have disease in the arteries in the legs, most likely you're going to have disease elsewhere in the body. And that's the significance of PAD or peripheral vascular disease. It's not that you can't walk because your legs don't have a good blood supply. It's because if you have disease inside of your legs, you probably also have disease inside the coronary arteries. And that's why you have an increased risk of heart attacks and heart disease.

And you can also have the same process I showed you before going on in the vessels up in the neck. And if they're affected up in the neck, then little clots can break off where you lose the blood supply to your brain; and you end up with stroke or blindness. So the real problem with all of this is that your vessels are diseased systemically. Hopefully, your first presentation with this disease process is going to be claudication -- that you're going to have pain in your legs. Something is not right. You used to be able to play 18 holes of golf no problem – could walk the whole thing. Now you can't walk to the golf cart.

And you come to your doctor and you say, "Doc, I can't walk anymore." And your doctor looks at you and says, "You know what? You need to get more exercise because you have PAD or peripheral vascular disease." And the patient looks at their doctor and says, "Yeah, I'd like to do that; but I really can't walk." So it's kind of a Catch 22, and the object here is to get the patient healthy enough to start taking care of themselves because this is not a cureall. We're trying to fix the disease in the legs so that the patient can adapt a healthy lifestyle.

And that's what Dr. Andrea, my wife, deals with all the time. She's got a big diabetic population. They come in after living a whole life pretty sedentary with poor diet, and so on and so forth. And she helps them get back to a healthy lifestyle by teaching them how to eat right and basically how to get out and move around and exercise, correct?

Absolutely, that is so important. And when your doctor says to stop smoking, that is probably one of the hardest addictions to quit. But the problem is when you put one of these stents in and then you go back to smoking, it will enhance those re-stent/ in-stent stenosis.

That's exactly right. That's the problem. You get patients, you treat them, you do atherectomy, you do stenting. If they don't stop their bad habits, this all comes back. So the legs are probably almost always affected because of the nature of the disease. But the most important part is that it's also affecting critical arteries, like your coronary arteries and the vessels up in your neck. And that's probably most important because that's what's going to kill you. Hopefully, your first presentation isn’t a sudden heart attack or a massive stroke.

And some specialists actually, if you're smoking – at least in the old days – they used to say, "Sorry, we're not going to do this procedure on you. Quit smoking and then we'll talk to you."

Well, I'll tell you, that's not unreasonable. I make a deal with my patients. I say, "We're going to make you better, but then you have to take control of your life. You have to do something."

Let me break in here for just a second because we've got our atherectomy device in position. And if we can go to the left – the live fluoro screen – there we go. And you can see the atherectomy catheter has a little notch, which is right at the very top of the screen. There's a little notch in the catheter. That's where the cutting blade is.

Dr. Klioze, I don't know if you've shown the video yet – the atherectomy video that describes how this device works. But it has a little cutting blade that we're going to bow against the wall of the vessel and then turn the blades on, and we're going to sort of shave the plaque off the inside of the vessel.

All right, while you do that, can I show this video so people know what's going on here?

Please.

Excellent, okay so let's go ahead and look at this video about the atherectomy itself; and we'll show you what's actually happening. We did a little bit of this earlier, but we're going to look at a plaque inside of the vessel. This is that plaque right there. The first thing we do is to get a wire across it, which Dr. Tonkin has already done. This is the atherectomy device. This is the cutting blade that he was talking about. When you turn this on, it brings the cutting blade back. It rotates, and actually shaves the inside of that plaque down. And you can pass this multiple times.

We look at it angiographically, and we try to figure out if the patient looks better. And you're going to see over time that she will, in fact, look better. Multiple passes go all the way around, 360 degrees. And as we shave stuff down, some of that debris may fall out. But the basket that Dr. Tonkin deployed earlier is going to catch that debris and make sure nothing goes flying down. So hopefully at the end of this treatment, what we're going to have left is a nice, smooth vessel wall that now the lumen has been restored.

So we made a few passes with the atherectomy catheter there, Dr. Klioze, and what were your--?

You're fast, Dr. Tonkin. You did that all in that one video, huh?

What I'm going to do is we'll show you more of how that looks going through the vessel in just a second. But hopefully James can clean some of the atheroma out of the tip of the device; and we'll be able to show the viewers what that stuff looks like. And in the meantime, I'm going to take a couple of follow-up pictures here – make sure everything is looking--.

Look at that. Okay, you're seeing him pushing the plaque out. This is the bacon that you had for breakfast, the cigarettes that you smoked, all that bad stuff that you're doing. This is what builds up inside of your vessel. You see it's white; it's glistening; it's fibrotic; it's not a soft, mushy plaque that you think about when we're talking about arterial disease. This is the stuff that narrows the vessel over time. And if she does not stop smoking or she doesn't change her lifestyle and become more active, this will return. But basically, what you're seeing is that atheroma that we showed earlier now being shaved out of the vessel.

I do want an opportunity to actually see that under fluoroscopy, Dr. Tonkin, when you get a chance there. That's a nice little pile of booty you got there, man. That was a good pass.

Right, and let's see -- we can show that last – I just did a follow-up run while you were showing emptying the catheter. We did a little follow up, and that's this right here.

Okay, let's go to the live fluoro again; and you can see the run. And we can see how well that turned out.

Yeah, we've got one little area of mild narrowing about two-thirds of the way up the screen that we're going to make a couple of more passes through there.

Let's go ahead and load the catheter on there, James.

And then we're going to go ahead and proceed further down the leg.

The picture that you were just seeing, just to reiterate, was about in the thigh region. And you can see that narrowing that's about two-thirds of the way up, like Dr. Tonkin said before. He's already treated the one up there more proximally, and we're just going to kind of march down.

Now, Dr. Tonkin, we have about 20 minutes left to finish everything up. So just to let you know, we've got about 20 minutes to get everything done and completed – not to rush you or anything.

All right, Dan, would you just pin that for me there? Okay, and we got it closed; correct?

Now, what Dr. Tonkin is doing at this moment is advancing the atherecting device back through the sheath that he put in earlier. And you've got to make sure the blade is inside of the atherectomy and that you're not cutting the sheath itself. And once he gets it in position, we're going to go to live fluoro. And we're actually going to see him pass the catheter down through the area of abnormality, which you see at the upper two-thirds of the screen right now. And we'll see the device actually being activated.

And you can see it all fluoroscopically. That's the great thing about doing this. We are the pioneers of minimally-invasive procedures, and that's what you're seeing right here. It's not a big incision. It's all done through little incisions to get access to the vessel, and now we're going to treat that vessel. You can see the blade is actually forward, and we're going to pull that back and atherectomize that vessel and basically shave that plaque out like we did before.

You can see on the live fluoro, Dr. Klioze, we've turned the little notch out there lateral in the vessel. And we're going to get it poised really in the area where we've got that little bit if residual narrowing. And then we'll turn it on, and we'll make a pass or two through that area again, okay?

All right, James, go ahead.

All right, so you can see the change in the configuration of the little notch.

You can actually hear the buzzing too. That's the motor spinning the little cutting blade.

We're going to bring it back. We're going to spin it around so we get the opposite side of the vessel.

That's exactly right. So you can see he's changing the aperture to the other side – the little fenestration. And when he turns it on, the blade comes back, spins through the plaque and actually pushes the plaque hopefully into the nosecone of that little catheter.

Let's just do a little follow-up run right there. Did we give that Heparin gas? Okay, thank you. Oh okay, let's give that right now.

And we're administering during the course of the procedure, Scott, we did prior to starting the atherectomy. And now we're adding a little bit of Heparin, which is a blood thinner that we give intravenously or intraarterially during the course of the procedure to keep the blood real thin so that we don't add any propensity to cause thrombosis or clotting as a complication of the procedure.

Injury is one of the main reasons why people develop clots in the arteries or veins, and obviously we are traumatizing the vessel. So we're very cautious to make sure that we keep the blood nice and thin so that that doesn't happen as a complication of our interventions, whether it be angioplasty or atherectomy or even with stent placement in most cases.

Absolutely, Dr. Tonkin, can you do a little more manly injection there so we can actually see that vessel? It looks fabulous; but to the untrained eye, they may not be able to see your fabulous work there.

Let's go ahead and we could play that back for you in just a second, Dr. Klioze. But for the sake of coming in on time here, I want to go ahead and move down to this second area.

Fair enough, okay.

And we're going to again kind of zero in on the area of disease.

Is this the straight contrast? Okay, well let me just do a DSA then. Okay, there we go.

So you can see as we come down there, there's another couple of narrowings – one more distally.

Let's go ahead and let's really focus on that one. That's the one that's really causing flow issues, is that one right in there. So let's go ahead and do a full-strength contrast. Let's do a roadmap. All right, here we go.

Okay, while you're doing that, John, I'm going to answer another question here if you don't mind.

Go ahead.

So Julian, "Why do surgeons choose to enter the opposite leg, not the leg affected instead?"

Okay, that's a good question. And basically the reason that we enter the opposite leg is because we're trying to come down on the vessel. So we go up over the top and then come down and enter the leg that's abnormal. It's easier to go with the flow of blood. That's called a "retrograde stick," that's the way we get in, and then antegrade down the vessel itself. So to treat the right leg, we almost always go into the left side.

It's also easier to control the groin at the end. The other stick, where you go straight into the vessel on the same side as the disease, can be very difficult to control, especially if the patient has a pretty big panniculus -- if their stomach is hanging down over the top of the artery. So we try to avoid that if at all possible.

So we're back on live fluoro, and we're seeing Dr. Tonkin has gone down and is treating the next lesion the same way that he did before. And he's passing the atherecting device through the area of narrowing. And he's going all the way around – hopefully 360 degrees. You kind of concentrate on the area that shows the narrowing angiographically. So if it looks pretty good over to the right of the screen, you probably won't do too much atherectomy in that region. But if you see a lot of narrowing on the other side, then that's what you're going to concentrate on. And you can see the little cutter actually acts like a gauge so you can tell how much plaque is sitting inside of the vessel.

So they're going to take that out. They're going to take another look at it. And in the meantime, can we go to the computer screen? I want to show you some of the other ways that we can treat vessels. This is the balloon angioplasty. Like we talked about before, there are different ways to treat these vessels. The balloon angioplasty is you go inside and you actually open the vessel up with the balloon. This works well if the plaque goes all the way around the vessel. If it doesn't go all the way around, then it's not going to work very well; and you actually crack the inner and the medial lining as you stretch the outer adventitial lining and open up the vessel that way.

The other treatment of course is a stent. And a stent is a framework that's going to hold the vessel open. It's very good in certain situations – high flow vessels, big vessels. But the problem is you are leaving a foreign body behind. And when you leave a foreign body behind, there's always a chance that the body's going to respond to that. Platelets will stick to it, and you can clot that thing off. And that can be a problem because you can restenose that vessel. The leg vessels are very close to the skin surface. So we try not to put stents in these if we can avoid them. We try to go in, open them up, give you a normal vessel – a natural vessel like you were born with – and hopefully avoid putting any kind of foreign material in that particular area.

So what we're seeing right now on the screen is they're removing some more of that plaque. This is more of that bacon and cigarettes that we talked about earlier. We've shaved the inside of that vessel down, and that's what's coming out right now.

There was a great question by Gabriel, "Do you have to replace the stent in the future, or is it permanent?"

Okay, that is a great question. The stent usually stays in. Stents are permanent devices. We're not putting a stent in. We're only going in and doing the atherectomy -- avoiding the stent altogether. The atherectomy basically allows us not to leave anything behind, like I talked about before. But the stent, sometimes they will close back down. You can't remove it, unfortunately. Once it's in the patient, it stays there. You can go back in and treat it again either with a balloon angioplasty, or sometimes we put another stent inside of that stent. But that's an excellent question.

Why don't we look at a couple more questions here while we're waiting for the guys to set up and finish up what they're doing?

So Amy from Fort Myers was asking, "What is the average age of the patient?"

That's a good question also, Amy, because the patients that we see range anywhere from 40 up until the 80s. I can't give you an average, but it depends when they started treating themselves badly. So if they started smoking at the age of 10, we may see them in their 30s or 40s. Just like they're more prone to heart disease and stroke and so on and so forth at an earlier age if they've been abusing their bodies longer. For those patients who were able to stave off those bad habits until their 30s, we may not see them 60s, 70s, plus.

How are you guys doing over there?

Good – we're getting set up, Scott. We've made a few passes through that distal lesion, Dr. Klioze.

Can you pin that wire for me, Dr. Miles?

And we're going to go ahead and make a few more. We've still got a little bit of progress we can make there. And then I'm hoping we're going to be done. We'll obviously do some completion pictures. We'll show everything very nicely, and hopefully everything will look good.

We actually (inaudible) the lesion by at least 50% with the first couple passes that John sent the atherectomy catheter through.

All right, we've got about ten minutes left. So we're going to go and kind of finish things up – maybe answer some more questions.

That looks great, John, Dan – that really looks nice. So you're going to go through and make a couple more passes?

Let's just show that again, Scott, if you don't mind. Just stay with us here for just a second, and we'll show just our last view. And this is a directional device, so we look like we have some narrowing there on the lateral part of the vessel. So we're going to—

Dan, will you activate that for me, please?

Okay, we're going to go ahead and we're going to just take it right down through there slowly again, focusing on the lateral wall of the vessel.

Okay, off.

And let's do maybe one more. We'll just turn very slightly – and again.

Very nice, and again, Dr. Tonkin is just going through the vessel – shaving the area of narrowing down, concentrating on the area that looks abnormally narrowed angiographically and staying away from the wall that he's already treated, which looks pretty good at this point.

Let's take a quick peak there.

So you're going to do an angiographic run – see how that looks?

Yeah, I'm not going to take the catheter out in case we want to make another pass or two.

Sure, sure.

This actually may serve as our completion look at this lesion here. We've got to go down – now, after we're done with this, we always of course – oh, that looks great.

Let us take a look too. We're all on the edge of our seats here.

And basically the lesion is completely gone. It looks like a normal vessel at this point.

Now, one of the points that atherectomy – I'm always amazed at atherectomy being really the only modality that we have that effectively preserves or sometimes even improves the collateral flow. It actually opens up branch vessels as opposed to closing them off, which angioplasty and stenting can do. And you can see we still have very good flow in the branch vessels in that area.

I'm going to go ahead and take the catheter out just so we can get a better set of pictures to look at.

Sure, let's get another picture. John, can I show the other leg that you guys treated three weeks ago while you do that if I have a moment here?

Yeah, please do.

All right, let's go back to the computer screen. And I just want to show you what we had previously. This is her left leg. And we chose a pretty simple lesion for the demonstration purposes. This is what she had on her left. You

can see this is the profunda, the deep vessel. The whole SFA is out. It is not even there. And Dr. Tonkin successfully traversed that vessel, staying right in the middle, intraluminal not subintimal, and you can see after we did the atherectomy and we did the balloon angioplasty just like you're seeing here. We went through and made a couple of passes. I know you've seen this video a couple of times now.

And following that, we usually do an angioplasty just to kind of smooth the vessel wall out after treatment. And you can see what a marked improvement. Now, look carefully. This is the before. You can see this vessel is completely out. This is the leg that she had the ulcers in – the MRSA, which is the methicillin-resistant Staph aureus. It was a mess; she couldn't walk. After treatment, this is what that vessel looked like, so you can see remarkable change. This is a dramatic example of what atherectomy can actually do. And there's no stents. There's nothing left behind.

We have Michael from Daytona. It says, "What are the advantages of atherectomy when compared to endarterectomy?"

You guys are asking great questions. An endarterectomy is a surgical procedure where a surgeon goes in and opens up a vessel. Still a great procedure – especially where the vessels are very superficial. And in our community, we have fantastic vascular surgeons, especially when you're talking about vessels up in the neck. We don't do atherectomy up there. Throwing debris up to the brain is bad form, so we don't try to use an atherectomy catheter up there.

They are so good at doing an endarterectomy where they open up that vessel. They actually shell out that plaque that I showed you previously and basically put a patch on there and open the vessel back up. That is an endarterectomy. It's hard to do an endarterectomy in the vessels in the leg itself. So you have to treat those with either balloon angioplasty, surgical bypass, stent, or atherectomy. And in my opinion, for reasons that we've stated before, atherectomy is probably the best way to go if it's technically feasible.

How are you guys doing? Anything to show us in there?

If you want to look at that run there, Dr. Klioze.

Okay, let's go to the live fluoro again and take a look at what Dr. Tonkin is trying to show us there.

Okay, and that's the proximal thigh. And Dr. Miles can go to the previous image.

Dan, if you could do that for us, please, and then we'll show the – yeah, go to the previous run. It shows the distal thigh to the knee right there.

Oh, looks great.

And now what I'm going to do is we're going to go ahead and remove the distal protection filter – the basket filter. So we're going to go down and usually do this under careful, direct visualization because we have to make sure that basket folds into our little retrieval catheter and comes out smoothly. And we'll see if there's any debris. And we can actually take that onto the back table again and see if we've captured anything. In most cases, we do; and it will look exactly like the stuff that comes out in the atherectomy catheter, and it would have otherwise have ended up down in the foot.

Okay, so we're going to go ahead and advance the little retrieval catheter over the basket. And then the basket and the wire come out.

Excellent.

And we'll take a look at it on the back table and see if there's anything in there.

Dr. Tonkin, we've got about five minutes left – not a lot of time. So let's go ahead, and can we forego looking at the basket and proceed on here?

No, you guys have time to look at the basket. I'm going to take a picture of the groin, and then we're going to close the groin with a suturing device. That will only take us just a quick second.

Okay, good. Let's go back to the computer screen, and I'm going to show you what Dr. Tonkin is going to do here. Basically, this is that closure device. It's called a "perclose," and what he's going to do is insert this over the wire. And when he gets this into the patient, these little footplates come out. And he pulls that up against the anterior wall of the vessel. And then, as he pushes a little plunger down, which you'll see momentarily, two little needles come out. They stick through the vessel wall and they grab a suture – a ligature on either side. They pull that up through the vessel wall and then you take the whole device off. And once you get the device off, you basically have this suture and you use that to close that hole. And the great thing about this is that you get out, and the patient is basically done. You keep them around for couple of hours.

We had a question here, "How long is the recovery?" Essentially we keep the patients around for a couple of hours and make sure there are no bleeding issues. And they can go home the same day. And a lot of it has to do with this closure device because we do keep the patients anticoagulated. So we're going to go ahead and see Dr. Tonkin do that real quick.

I wanted to talk to Dr. Klioze here about some fat and fatty metabolism and how she's doing with her patients. But we'll see how Dr. Tonkin and staff are faring.

What I'm doing, Scott, I'm going to apply pressure up here. We've got a puncture in this artery, so it's arterial pressure. It's the size of this catheter that's going into the skin here that we were working through. And what we're going to do is John is going to take that out. I'm going to apply some pressure to hopefully stop any of the blood from coming back to the puncture site while he gets the closure device in there.

Got it?

I got it.

All right, so we're leaving the wire in so we can introduce the perclose suture.

While you're getting that down – just real quick – "I have a friend who is a 75-year-old who I believe might be related to this disease process. What should I tell him to do?" Well, he needs to talk to his doctor. If he really has PAD, he can call 1-877-8halifax. And we can talk to a physician there. We can get you set up, and we actually take a look.

And let's go back to Dr. Tonkin, and he's going to show us his completion there.

We just have a good look at the groin here. You can see the small size of the incision we made – just a little nick in the skin. We have good hemostasis. And that's the end of the procedure. Thanks very much for watching.

Dr. Tonkin, Dr. Miles, you guys did a fabulous job – fantastic – really showed your skills off there. We really appreciate you getting through in the hour.

I want to thank a couple of people. We've got AVID Medical; they have the perclose device that we used to close the groin with. They also gave us some video support.

We have video support from Covidien Medical that used to be ev3 and I think before that they were FoxHollow. They gave us some video support as well and Boston Scientific.

I also want to thank my panel of experts: Dr. Andrea Klioze, my lovely wife. Hopefully we'll get you back on and actually talk about diet and exercise more thoroughly at another event.

Dr. Tonkin and Dr. Miles, who were on the hot seat, did a fabulous job; the ORLive crew, who brings this to us every couple of months; and most importantly, Halifax Health, who pays for the whole shindig and makes sure you guys have a quality educational experience.

We really thank you guys for tuning in and watching. Remember, if you learned something tonight and you want to show your relative Bob over in England, it is on the World Wide Web as soon as we're done here. They can log on to halifaxhealth.org, go to the video link, and actually see the video whenever they want to. As always -- stay happy, stay healthy, and we'll see you next time on OR webcast