NARRATOR

When Carey Laniere’s defective heart valve began to wear out, Wake Forest University Baptist Medical Center surgeons replaced it with a Freestyle stentless porcine aortic root bioprosthesis. They chose a natural tissue valve over a mechanical one so that Mr. Laniere could continue with his active life that includes competitive tennis four times a week. The advantage of the natural tissue valve is that it provides for a normal laminar blood flow not obtainable with a mechanical valve replacement.

NEAL KON, M.D.

The hope is that we’ll replace the valve with a natural valve that will have durability greater than 15 years and that the flow patterns will be completely indistinguishable from the normal human aortic valve.

NARRATOR

During the next hour, you will see the cardiothoracic surgery team at Wake Forest University Baptist Medical Center perform portions of a total aortic root replacement using the Freestyle stentless porcine aortic root bioprosthesis. You may send questions to the operating room at any time by clicking the email button below. Surgeons will attempt to answer as many questions as possible during the live program. If you have registered for continuing medical education, be sure to complete the post-test at the end of the presentation to receive credit. This live internet broadcast from Wake Forest University Baptist Medical Center in Winston Salem, North Carolina, is part of the Medical Center’s ongoing efforts to bring the latest in medical care to its patients and medical education to the health care community.

A. ROBERT CORDELL, M.D.

Good afternoon. This is a live view from operating room 28 at Wake Forest University Baptist Medical Center, where we’re performing a total aortic root replacement using the Freestyle stentless porcine aortic valve prosthesis. Our surgeon today is Dr. Neal Kon, who is Chairman of the Department of Cardiothoracic Surgery, and we will be hearing from him shortly. In the meantime, I’d like to mention that you are free to send us questions, which you can do by virtue of touching the tab at the right lower corner of
your screen, and we’ll try to see how we can field them and answer them for you as best we know how. I’d like to add also that the operation today is more than just a total root replacement and that a hemi-arch of the aorta will be included as part of the operation, which will be interesting because Dr. Kon will utilize time and effort in terms of reducing overall time in order to accomplish both of these procedures.

Now, I’d like to ask Dr. Kon if he would introduce his team to you. Dr. Kon?

NEAL KON, M.D.

Welcome, everybody. We’re in the process of stopping the heart here and I’m infusing some cardioplegia into the coronaries. The retrograde cardioplegia line to the coronary sinus is quite big, so the pressure didn’t go up as well, so I’m supplementing our cardioplegia with this. Welcome. I’m going to be doing the operation. Dr. Ted Kincaid is going to be my first assistant and Dr. Kincaid finished our program two years ago and is one of our superb residents we’ve kept along here. Mr. Sid Lavender is the physician’s assistant who will be assisting us. Terry Ballard and Lisa Engelbert will be the scrub people. Tim Maloney is going to be running the heart and lung machine. Dr. Richard Prelip is our anesthesiologist working here and Bob Hofsteder is our circulating nurse, so you can tell that it takes a lot of people to do an operation like this. There are a bunch of other people from the internet broadcast which I’m not going to introduce, but there’s a lot of people, obviously, involved in doing this.

Okay, let me show you what we’re up to. As A. ROBERT CORDELL, M.D. said, we’re going to do a total root replacement and we’re doing to replace the rest of the ascending aorta. This patient’s anatomy is quite favorable. This cannula is actually in the aortic arch here. We have a cross clamp here, since he has significant aortic insufficiency, and we’re cooling the body temperature down to $18^\circ C$ so we can turn off the pump for a brief period of time. We have transected the aorta just above the sinotubular junction. Here’s the left coronary os and here is the right coronary os. This is an important time to notice whether you’re going to rotate the Freestyle graft or not when we get to it and I’ll show you that, but the coronaries are close and this right coronary here, which we’ll pay particular attention to, is rather high. Usually the right coronary is displaced toward this non-right commissure, but today’s it’s displaced more, actually, toward the left-right commissure, so we’re not going to rotate the Freestyle valve like we do about 80% of the time. The leaflets here are quite thin. There is some fusion of the left-right coronary leaflet, making it a functionally bicuspid type valve. On the echo, we saw this leaflet, the non-coronary leaflet, prolapsing below the plane, creating aortic insufficiency, so we generally start this by dissecting the aortic root, which we will do first, and I think one of the key points here is to mobilize the pulmonary artery off the aortic root and just start by following that.

A. ROBERT CORDELL, M.D.

Dr. Kon, could you brief us on this patient’s history and examination and so forth?
I will in a moment. Let me get this pulmonary artery off. This patient is a 75-year-old gentleman who presented with significant shortness of breath and fatigue. In his workup, he was found to have aortic insufficiency. He was also found to have a pulmonary embolism, so we allowed him to get over his pulmonary embolism. This was all about three months ago. A lot, but not all, of his shortness of breath improved. He’s a significant exerciser, so I think putting in this type of stentless valve will give him optimal hemodynamics and will serve him very well. He’s a very active 75-year-old gentleman and an extremely nice gentleman, I might add. Here we’re mobilizing the non-coronary sinus and you can see this is markedly enlarged, so we’re just going to get rid of it.

Okay, let’s come back over here and look at this pulmonary artery. You can see that when you move the pulmonary artery all the way around, like this, you’ll have a wide opening here to mobilize the coronaries. So it’s adequately mobilized and we’ll mobilize the left coronary os now. By taking the pulmonary artery away here, you can see this becomes quite simple. Now, the key thing to make the left coronary adequately mobile is to mobilize the rest of the root here. Once we cut the coronary off, this little aortic lip, we cut some of this tissue here and that gives you a very mobilized left coronary to work with.

Next we’re going to mobilize this right coronary. You can see I’m not taking the whole sinus out on the button because this is a very large sinus to Valsalva and the tissue is obviously abnormal, not tissue that we want to necessarily save, so here we’ve got a nice right coronary button. When you do that, then mobilize the rest of this aortic wall, that’s key to making this coronary very mobile.

Now I’m going to take out some more of this sinus tissue because it’s significantly enlarged, so we’re left here with the aortic valve and we’re going to remove the leaflets now. Remember, there’s some fusion of the left-right and prolapse of the non-coronary leaflet

Dr. Kon, do you have any ideas about the pathology of this valve?

It looks mostly like myxomatous degeneration. As I mentioned, there was fusion of two of the leaflets, partial fusion, but this is primarily degenerative disease of the sinuses of
Valsalva and the aortic valve leaflets. Some people, we talk about doing aortic valve sparing operations, but there’s enough abnormality in this leaflet tissue and prolapse of one of the leaflets that make that, I think, not a good choice for him, especially him being 75 years old. He should not outlive the Freestyle valve that we’ll put in.

So here is the aortic annulus. We’ll use a 29 Freestyle valve, which is the largest they have, and that’ll give him a 3, 3.5 effective valve orifice, which will be just outstanding. Let’s go to Trendelenberg. If you plan the operation right, you get to the right temperature at the right time, so we’re going into Trendelenberg and we’re actually going to turn his circulation off for a short period of time. We’re at 20°C. We want a 24 Hemashield graft.

A. ROBERT CORDELL, M.D.

It looks like he will be inserting approximately 4-5, perhaps a bit more, cm in the length of the ascending aorta up to the transverse arch. The clamp is off. 20°C temperature.

NEAL KON, M.D.

We use a 4-0 Prolene suture for this anastomosis. You can see we’re above the aneurysm now. The aorta is normal and we’re cannulated above that. What we’ll do is cut this graft like that. We don’t want this graft to be any...often I bevel them, but this beveling is already a little big, 24, for his aorta, so we’ll leave it exactly straight. We’ll bevel on the other side to contour this graft when we attach it to the Freestyle root bioprosthesis.

A. ROBERT CORDELL, M.D.

We have a question coming in, which is interesting, from a potential patient who says, “I’m having a valve replacement in March. I’m 47 and in good health. Because of my age and lifestyle, I’m looking at a Ross procedure. I do not want to take Coumadin forever, nor do I want to do this again in 10 or 15 years. Your comments on the Ross procedure?”

Dr. Kon, would you like to make any comment on that question?

NEAL KON, M.D.

I wouldn’t do a Ross operation on a patient with this type of pathology because he has dilated sinuses, even if he was 47, because of the myxomatous pattern of his degeneration. You would anticipate that that might be in his pulmonary artery and if you subjected the pulmonary artery to systemic pressures, it too would become dilated like this, but for other disease pathology, like a straightforward bicuspid valve, without so much significant dilatation, I think the Ross operation is an excellent choice for an active 47-year-old gentleman with no coronary artery disease, like this patient. So I wouldn’t do it if I saw the pathology like this, where there was so much sinus dilatation, I would not do a Ross.

A. ROBERT CORDELL, M.D.
So what he’s saying, in essence, is the fact that perhaps for your valve need, providing it’s not as diseased as the aorta is in this patient, he feels that Ross procedure is a very good alternative and would hopefully stand you in good stead for prolonged function of the transplanted pulmonary artery.

NEAL KON, M.D.

I would add that if this patient is 47 years old, wanted to be active, and had this type of pathology, where we would not do a Ross, the other two natural options that we’ve used are this valve here, Freestyle, or a Homograft. I’m a little more encouraged about our Freestyle data than our Homograft data and probably, since all sizes are available with the Freestyle, would choose that, even though knowing in his lifetime he would need a reoperation, but it would keep him from having to take Coumadin.

A. ROBERT CORDELL, M.D.

Thank you. Another question is what is the normal length of time needed to complete this procedure? I think I can answer that for you, Dr. Kon. They usually somewhere between 3 and 4 hours for this operation, which is not very much longer than many other valve procedures require.

Another question. Is this procedure recommended for those who have Marfan’s syndrome? Your comments on Marfan’s?

NEAL KON, M.D.

I think this is an excellent case for Marfan’s. You have to look at Marfan’s, whether you’re going to want to be doing a reoperation. Obviously if you use tissue, there’s a use in young Marfan’s that they’ll need a reoperation. We do a lot of aortic valve sparing for Marfan’s, where we try to maintain the patient’s aortic valve, called aortic root remodeling, or operations that are described by Dr. David and Sermagee Akou, but in cases where the aortic valve is also abnormal, like a bicuspid valve, like this, in Marfan’s, I would choose this operation, a Freestyle stentless valve.

A. ROBERT CORDELL, M.D.

I think that’s very true and I would agree that the pathology, the abnormal tissue in Marfan’s syndrome, which needs buttressing particularly at the level of the annulus, where the valve tissue tends to be very closely adherent or designed, this would be a worthwhile operation.

Another question of interest: Do you believe that the Freestyle aortic valve or aortic root replacement has the potential to eliminate the need for actual human aortic root donations?
NEAL KON, M.D.

Are you going to take that or do you want me to?

A. ROBERT CORDELL, M.D.

I’ll be glad to have your comments and then I’ll make mine.

NEAL KON, M.D.

Well, I think the real advantage of the Freestyle over the homografts is it comes in all sizes, so when you talk about the Marfan’s patient, you know, maybe that’s young and generally large people, tall people, if they want to be active, it’s much harder to get normal human valves that are large and the Freestyle valve comes in all sizes. There’s no hemodynamic advantage to a homograft over a Freestyle valve, so I think in instances where you have difficulty getting homografts, certainly of the correct size, this is a superb substitute for it.

A. ROBERT CORDELL, M.D.

I might add, in addition to that, that we have done a large number of human allograft foot replacements. We maintain an aortic tissue bank, but as was mentioned by Dr. Kon, we certainly don’t have enough of varying sizes in order to allow us to do the numbers of cases that we do of root replacement. As a matter of fact, over the years we have done over 1,000 aortic root replacements in the past 10-11 years, but a relatively small proportion of those was with the use of human aortic root tissue because, in fact, they’re simply not available to that degree.

The next question is what is the material of the prosthesis that you’re going to use? It is a Dacron prosthesis which is knitted but which is bathed in a plasma type solution, which tends to make it much less likely to bleed when subjected to the pressures normally associated with coming off pump and prior to the time when the clotting mechanism has been corrected and clotting becomes more normal.

We have one other question which is interesting. This patient says I’m having open heart surgery on January 16. I’m a male of 52 years. He’s having it done, apparently, for severe mitral valve prolapse. It’s to be performed at Vassar Druthers Hospital in Poughkeepsie, New York. I have osteoporosis and am wondering if this operation can be performed without breaking the sternum. Also, what is the success rate for my type of operation? I’m 5’10”, 164 pounds.

NEAL KON, M.D.

I’m going to interrupt for one second and show what we’re up to right now. We’ve returned our attention to the aortic root. We’ve finished the hemi-arch. We’ve got a clamp on the graft. We had a seven-minute period of circulatory arrest. Now we’re
putting sutures in to accomplish the proximal anastomosis of the prosthesis to the heart. We’re washing a 29 mm Freestyle valve and we’re putting these sutures in. The first thing we do is line up the left coronary artery with the first stitch and we’re going to have this stitch end up lining up the coronary with the bioprosthesis when we select it. Usually the junction of the anterior leaflet of the mitral valve and the muscle here is the point where the left coronary is and it is in this patient, so we’re going to put all our sutures in the good stuff, the strongest tissue here, in a single plane right around the left ventricular outflow tract, so that’s what we’re up to right now and I’ll give it back to you, Bob.

A. ROBERT CORDELL, M.D.

Okay, do you remember hearing me so far? I’ll be glad to re-read it. In essence, it’s a 52-year-old gentleman who’s having surgery for severe mitral valve prolapse on January 16 in Poughkeepsie, New York, and he’s wondering whether they can do the operation without breaking his sternum, and he’s also wondering what the success rate for the operation is. He’s 5’10”, 164 pounds, with an enlarged heart.

NEAL KON, M.D.

You’re talking about mitral disease. You’re talking about a small incision. The small incision mitral surgery can certainly be done without breaking the sternum and going through a thoracotomy incision done through a smaller incision, smaller approach. I think it’s a good option for that.

A. ROBERT CORDELL, M.D.

Probably we would expect that they would make every effort to do a repair of a mitral valve, if possible and if safe and considered safely done by your surgeon, to the extent that you would not require a replacement of the valve at this time and hopefully not ever. In terms of the durability of such operations, they’ve only been done really in large volume for 15-18 years, but so far they’ve held up extremely well and certainly, if they can be done successfully, they’re preferred over the insertion of a prosthetic or mechanical valve.

We have another question. Does this patient today need Coumadin after the surgery for some limited time? The answer to that is no. We do not use Coumadin for that purpose in this kind of valve surgery, using this kind of prosthesis, unless there is some other reason besides the surgery that’s being done on the valve, which would mitigate the use of Coumadin, but that’s one of the big advantages of the use of this prosthesis and of this type of operation. The patient does not have to use an anticoagulant terminally for the rest of his life, which is necessary, of course, for all prosthetic valves of a mechanical nature.

That’s all the questions that I have at the moment, but we’ll be glad to receive others or discuss them if you have questions to ask us. Dr. Kon at the moment is placing sutures in the aortic annulus, consistent of a Dacron suture 3-0. He’s also including, as you might notice, a cuff of Teflon felt and the purpose of that will become obvious a little bit later
on, but the purpose of this point is that, when tied down, it will help to create a watertight or blood-tight anastomosis without leak and will be essentially outside of the blood stream, making it quite safe and practical. He’ll put approximately between 30 and 35 such sutures in place. They’re all interrupted and they’re placed relatively close together, 1-2 mm apart.

NEAL KON, M.D.

You can see that we’re coming up by the right coronary here. We know from experience that we’re exactly in the right spot where we want to be on the bioprosthesis when we put sutures in under the right coronary. We’ll probably put in between 28 and 32 of these sutures. They’re in simple interrupted fashion. One of the things that makes this operation smooth is these suture guides we used. They were designed by Drs. Gabe and Frader and they got an A and a B spot. I think A stands for above and B stands for below. The needle that’s above the annulus goes in A and the needle that’s below the annulus goes in B, and the needle that’s below the annulus in B is what’s going to go in the bioprosthesis when we bring that up.

A. ROBERT CORDELL, M.D.

I have some information also to let you share and know that, even though we planned for our webcast today to last one hour, due to the nature of the procedure and this patient’s particular case, we anticipate that it will perhaps last slightly longer than that, but we will be able to carry along that time if it’s necessary. For anyone wishing to take the post-test for CME credit, you should be able to do that successfully after one hour and we’ll put up a reminder to you at that point.

We have a question which has to do with the duration of these materials, this porcine graft. In other words, what is the life of a Freestyle valve? We don’t really have the answer to that. We’re still observing patients who have this valve in place. We have observed many patients in our series who are at a 10-year time period at this point and they’re doing extremely well. As a matter of fact, out of the total group which I mentioned to you earlier, which now numbers in all cases around 1,000, we have had to replace only 4 of them and 2 of those were from infection of the valve and 2 of them were for valve deterioration, recalcification, so thus far we’re optimistic about its durability, but we are continuing to observe all of these patients on an annual basis with echocardiography, physical exam, etc., and hopefully we will see them very durable over a period of increasing years.

Another question regarding technique. This person notices that you’re not using any Teflon buttress in the distal aortic suture line. Do you have any comment to make?

NEAL KON, M.D.

I don’t think you need it. When you have the patient under such optimal conditions to sew and the tissue looks good and strong enough that there’s no problem making that
anastomosis without leakage. Now, I must admit that if I was questioning the integrity of the tissue, I would use some Teflon felt there or bovine pericardial strip or bioglue or something like that, like in a dissection, but in this, the tissue integrity is quite good and we’ve done lots of those and that’s not a place we’ve had trouble with bleeding, so that’s why.

A. ROBERT CORDELL, M.D.

In essence, we don’t see the need and we’ve used it in very few patients in this series.

Another question. I’m a 32-year-old first year medical assisting student. I am considering cardiovascular field. Would you recommend this field for me, at my age? I have two children. Dr. Kon, would you recommend a 32-year-old going into cardiovascular field today?

NEAL KON, M.D.

Absolutely. I can’t think of a profession more rewarding.

A. ROBERT CORDELL, M.D.

Even though you realize that you’re asking those of us who have devoted most of our lives, one way or another, up to this point, in cardiovascular surgery, I think you can certainly understand that, trying to be as objective as we can, we would certainly recommend it and feel that it’s a wonderful, wonderful field to be a part of.

A question concerning the delicacy of the procedure with the question of what the recovery time frame is in comparison to other delicate procedures.

NEAL KON, M.D.

Recovery from this operation, patients are generally in the ICU for a day or two. They’re in the hospital for about 5 days. Generally they can go back to light work at about 6 weeks time period and the sternum and everything is completely healed by 2.5 months.

A. ROBERT CORDELL, M.D.

I think that’s a good answer and I think it’s true. I think in particular this patient, who seems to be very highly motivated and who has been very active in physical exercise, walking and running and so forth, he might well surprise us.

NEAL KON, M.D.

We’re fussing with the coronaries right now, if I might interrupt. You can see we made an opening in the left coronary and that’s going to make the right coronary fit just right, so that’s where we’re going to line this up exactly.
A. ROBERT CORDELL, M.D.

You can see the coronary buttons there, which are close to where he’s going to open that graft and create an opening for the suture on of that coronary artery. He’s now beginning to place the other end of that suture into the proximal cuff of the graft and that will be done all the way around, for all 30 or so sutures, prior to tie-down of those sutures.

We have another question which is interesting and might well have come from a student in high school or middle school, who are also watching today. How are you keeping him alive during this surgery?

NEAL KON, M.D.

I’ll let you answer that, Bob.

A. ROBERT CORDELL, M.D.

Yes. Well, this patient is presently on what we call heart-lung bypass, which is done through a heart-lung machine and an oxygenator, so that we are providing adequate blood circulation to this patient all of this time and we are measuring oxygen levels, we’re measuring pressures and so forth, as a routine with these patients and we’re also monitoring his body temperature, which is somewhat cool in order to require less in the way of oxygen need, but he will remain on bypass for his protection up until the procedure is essentially completed and the time when he can be removed from that support and then the remainder of the procedure, with closure of his chest and so forth, can be carried out. You can see from that monitor, his mean blood pressure is 57 mm Hg, which is considered adequate for a patient at this stage, particularly in view of the fact that this is a mean pressure, not a pulsatile pressure, so it’s a more effective blood flow in a mean sense than it is in a pulsatile sense.

NEAL KON, M.D.

I had a comment about putting these sutures in now, about the spacing of these sutures. Can you all see these suture marks underneath? It’s about 1 suture per stitch here and that pretty much matches our spacing. We almost made this a follow the dots operation.

A. ROBERT CORDELL, M.D.

The dots that he’s talking about are actually small semi-micro type suturing which has been done in order to suture that very thing fabric onto the graft material. It’s done that way because of that, #1, it’s more easily sewn, but #2 is that in the pig aorta a good part of the annulus of the aorta is consistent with or is part of the muscular fibers.
You can see we’re right under the right coronary artery and we’re right under the right coronary artery of the bioprosthesis, so our coronaries are lined up perfectly, which makes me very happy and it’s going to come out just right.

A. ROBERT CORDELL, M.D.

You can see the biotissue immediately distal to where the suture line will be. I think we will begin now to review a few slides with you to summarize much of what you’re seeing and which hopefully will incite also some further questions.

Let’s ask the question why would one want to implant a stentless bioprosthesis when a stented bioprosthesis seems to work so well? That’s a good question that has been asked by many people. The main reason for that is shown by these photographs. The one on the left, which is a stented valve, has an orifice, as you see it there, which is not totally open. It’s only maybe 7/8 open compared to the size of the annulus, maybe even less, and it also gives you a very mixed flow recording, as you can see, below that level, whereas the stentless valve has a much larger orifice for the overall size of the valve itself and also gives a much more normal-appearing flow pattern, as you can see below.

Well, what do we know about these stentless valves? The one thing that’s important, of course, to us from a practical standpoint is the fact that they are available at any time. We have a stock of them on the shelf which can easily be made available for the needs of the surgeon. Importantly, no anticoagulation is required and we’ve found that they develop very lasting and very low pressure gradients across the valve in a functional sense, but they are particularly favorable in those patients who have a very small aortic root, so more concern occurs for pressure gradients when you have to put a mechanical prosthesis in place.

What do we not know about them? Well, we don’t know for sure and others are not certain of what the best implant technique is. There are a number of different techniques that are possible. Is there a higher operative risk for a patient if you do a full route against a lesser procedure? Is the long-term survival of the patient improved and are stentless valves more durable than mechanical valves? We’d like to discuss some of those issues with you. The two more common implant techniques will be discussed, along with data supporting the use of stentless valves. We’ll try to discuss briefly why bother in terms of controversial issues and perhaps a bit of information in addition to what you’re watching now in terms of the technique employed.

As most of you know, there really are four separate techniques which lend themselves well to using these prostheses. The complete subcoronary, on your left, is a standard technique and is done by trimming the aortic root and putting it inside the person’s aortic root with the coronaries primarily left in place. The modified subcoronary is very similar, except for the fact that it incorporates the known coronary cusp area also, but is similar in other respects. The root inclusion is one wherein you do put the entire root inside the patient’s aorta and connect coronaries to it afterward through coronary ostia. On the right is a full route, which you’re seeing done at the present time, which incorporates removing
aortic tissue, making buttons of the coronaries, sewing in the root, tailoring it as necessary distally, and sewing the coronaries as a button into their proper location.

It is true that with the modified subcoronary implant it’s important that your suture positions be in a straight line, rather than to follow the natural cusp scalloping which is present in the normal aorta.

In the modified subcoronary, as you can see, you have a long suture line which encompasses going around the coronary vessels and continuing on to the native aorta distally in order to, in essence, include only the valve itself that you’re sewing into the person’s aorta.

The total root, as you are seeing done at the moment, removes the coronary buttons. You take out essentially all of the proximal aorta and your insert your aortic root, which in this case is a porcine root, by interrupted sutures proximally with continuous sutures for the coronary reattachments and for continuous suture of the graft to the native aorta. Coronary buttons are, as you’ve seen, adequately mobilized in order to allow them to be sutured to the graft without any tension upon them. That’s very important. You’re seeing there now in the video, which you’re not seeing, I presume, since these slides are on, the sutures are in place and the graft itself is being lowered into position with the Teflon felt on the outside, but being included in the tie in order to try to achieve full hemostasis in that region and then the coronaries will be sutured, as they’re being done in this diagram.

NEAL KON, M.D.

I’m going to interrupt for one moment, just to let everybody know what we’re up to. You can see the left coronary lined up to the left coronary. See we have all these sutures in. There are 33 of them and they’re all around the outflow tract. We’re going to tie these. The Teflon-felted sutures don’t go through, but we made a ring that was the same size as the valve sizer and put a little hemoclip around it to make it into a ring. We started with a strip. Now we’re going to tie each of these sutures around and this will give us a secure proximal suture line.

A. ROBERT CORDELL, M.D.

Let’s go to an actual photograph of a valve prosthesis in place. It shows you some of the leaflets inside and it shows you the coronary being sutured in place. Let’s look at some of the hemodynamic data. Some of the facts that we’ve learned for stentless valves have to do with a lower incidence of a mismatch of the patient with the prosthetic valve and with better hemodynamics, in which case the degree of left ventricular hypertrophy, the thickness of the left ventricular muscle will regress markedly after proper insertion of an adequate sized stentless prosthesis. In addition, the flow across the valve may result in a better perfusion of coronaries. We’re not sure of that, but Genn and his group in Europe have suggested it. These factors might well contribute to a longer survival advantage in the patient compared to those with conventional stented devices. These patients, after they’re operated on, in this case from Canada comes this information, of 396 patients
who were recruited, undergoing a variety of valve procedures, as you can see from the
screen, a subgroup did get the evaluation carried out, 38 of them, with bicycle exercise.
It’s interesting to see these grafts of that. As you can see, the colors show you essentially
that homografts, green, retain a much lower gradient than the other valves, which is
remarkable but not unexpected. This also shows you, in terms of exercise effects, that the
SJM, the bottom one that you see, the St. Jude Medical valve, has a very low gradient to
start with, but the gradient rises, surprisingly, up to 25 or so in this instance, 24 with
exercise, as well as the Sorensen valve, simply meaning that many of these valves do
react with increased gradients with any significant exercise.

Do we have any improved life expectancy in patients following aortic valve replacement?
In this case, the Freestyle valve has a 0.86, whereas the Hancock 0.77 over a period of 5
years, which is a relatively significant .05 P value.

Does the implant technique matter? Well, many valves are being inserted in all of the
various combinations or techniques. It does appear, however, that in this series of
patients, for example, by Bock and his group, over a period of eight years, as you can see,
the amount of trivial to moderate regurgitation becomes more apparent in the higher
figure in those patients who have undergone complete subcoronary operations.

In the group of full root replacement that were done in this center, you’ll notice that 90
out of 100 consecutive patients had absolutely no regurgitation, whereas 10 had very
trivial and there were none in the mild to moderate or severe category, which we consider
to be an important finding in terms of trying to have these patients return to what amounts
to essentially normal function.

There are distortions which can be produced by freehand subcoronary techniques, which
any surgeon will tell you who has had significant experience using that technique. You
have to be careful about undersizing or oversizing. You have to be very careful about the
commissural angle alignment and you have to have a commissural height which is neither
too high or too low. Also, we’re all aware of the fact that progressive dilatation of the
sinotubular junction, as well as the course of the ascending aorta, occurs significantly in
many of these patients who develop that problem and, therefore, they end up in serious
trouble from leakage.

These are sound pictures done by one of the Japanese surgeons which compare the
stented ones to the subcoronary and modified valve insertion compared with full root
technique. If you’ll look at them again, you’ll notice that the size of the orifice is smaller
and the flow is more irregular. You can see modified subcoronary, which is also
somewhat decreased in size of orifice and in flow dynamics, whereas the full root has a
much larger orifice, along with normal-appearing flow dynamics into the aorta.

This is an interesting study done by Matsume and Osaka, which simply shows a
computer-generated image of the Grade A, which is near to normal; Grade B, which is a
mild disturbance; and Grace C, which is moderate disturbance, after these subcoronary
valves have been put in.
This is a group of patients who have undergone, in the blue, three separate root insertions of various tissue valves. In the subcoronary, you’ll notice that there’s a mild disturbance in terms of the technique. In the full root, you see absolutely no regurgitation and it’s comparable totally to the human valve, on your right, whereas significant blue is present, in the range of 40-50%, in the other set of patients.

NEAL KON, M.D.

We’re just finishing up here on this proximal suture line and we’ve tied all of these sutures. We’ve got just a few more to go, but you can tell that the Teflon felt is around the prosthesis. It’s important to make sure, when you do this type of suture technique, that you don’t allow the Teflon felt to roll under the prosthesis into the left ventricular outflow tract, so when we get done tying, I’ll show you the inside. All that the left ventricle is going to see is aortic valve leaflets. It’s not going to see any sutures. It’s not going to see any Teflon felt. It’s not going to see any of these multiple knots we’ve put in or any of that, which makes the incidence of things like thromboembolic events the lowest. It makes the flow pattern the most laminar and that’s what makes this technique indistinguishable from a normal human aortic valve. We’ve just got a couple more to tie, then I’ll show you that.

A. ROBERT CORDELL, M.D.

In the meantime, we have some questions which we might address. What is the Dacron ring, currently being sewn, used for? It’s being used primarily to assure a blood-tight anastomosis, which is essential in this kind of surgery because at this level it’s very difficult to reach this area surgically and to close any leaks which could occur, so every effort should be made to try to be certain that that suture line is blood-tight. That’s the main reason.

A message from another patient. My doctor said that he would have a better idea if he could do a Ross procedure once inside, something about how the artery...it’s not clear, the rest of this. If it cannot be performed, would you suggest a mechanical valve and put up with the Coumadin for the rest of my life? I’m having this done by Dr. Alan Wolfe at St. Joseph’s in Atlanta.

NEAL KON, M.D.

Here’s what the outflow tract looks like now. Here are the aortic valve leaflets and you see nothing but the porcine roots. You can see how there’s no sutures, there’s no nothing here but straight leaflets. That’s all that left ventricle is going to see when it ejects. Also you can see right now that the coronaries match up perfectly, the left and the right. I know that some people planned on being here just an hour, so I’m going to explain what we’re going to do. I know we’re going to stay on longer than that, but we’re going to do end-to-side anastomosis with 5-0 Prolene here. We’re going to do end-to-side anastomosis with 5-0 Prolene here and open this. Then we’re going to do end-to-end
anastomosis of this to the Dacron graft and that’ll complete the procedure. When somebody asked me to do this in an hour, I said that’d like asking someone to drive from New York to Boston in 45 minutes. I told them I wasn’t going to pass any stop signs, I wasn’t going to go through any red lights in this operation, so it was going to take us a little longer than an hour, so we’re going to go ahead and sew these grafts back on.

A. ROBERT CORDELL, M.D.

An answer to the question, which was if the patient is scheduled to have a Ross procedure and for some reason it cannot be done, would we suggest a mechanical valve? I think in this clinic we would not suggest a mechanical valve, but we would probably end up doing the same procedure that you’re seeing performed here, for the reasons that we’ve been giving.

Another question: This patient had a PE, I guess a pulmonary embolus. Will he get Coumadin postoperatively? Dr. Kon, do you want to answer that question? What is your plan in terms of Coumadin in this patient?

NEAL KON, M.D.

Because he had a pulmonary embolus, as stated, I’m going to put him on Coumadin postoperatively for three months, so he’ll complete a 6-month course of Coumadin and then we will go without any and he’ll go on just aspirin therapy. That is our plan.

A. ROBERT CORDELL, M.D.

I’m told that for those of you who are taking the CME, you’re conflicting some with the slides, so you can go ahead now and take your test as you see fit.

A question is being posed as to what is the immediate postoperative anticoagulation or is it present with Heparin, Lovonox, or Dextran? The answer is neither in most of these patients and I’m sure in this case also because he will be started on Coumadin, as Dr. Kon just mentioned, because of his prior history, relatively recently, of pulmonary emboli, but not in the usual situation.

Another question: I’m a 38-year-old male with Marfan’s. My aneurysm is at the aortic root. It is now 5.2 cm. At what size do you recommend this procedure?

NEAL KON, M.D.

I would recommend that he have surgery, that if his aortic valve leaflets are completely normal, that he have an aortic root remodel operation as the first choice. If the leaflets are abnormal or if it is felt by the surgeon that that operation can’t be done and he is young and will take Coumadin for the rest of his life, I would do a St. Jude mechanical valve conduit or a Med Hall mechanical valve conduit. If he doesn’t want to take Coumadin, I’d recommend that he have this operation and he can’t have an aortic root remodel.
A. ROBERT CORDELL, M.D.

One question: What’s the length of the valve you’re using versus mechanical valve?

NEAL KON, M.D.

The mechanical valve that has a conduit on it will go the entire length here, although since you can see we do these in separate parts, we would cut it in two, but a mechanical valve conduit, in terms of length, probably goes up to 20 cm. This is 2 inches, 2.5 inches.

A. ROBERT CORDELL, M.D.

We have a physician who says, any comments about the RBR vs. this procedure being valued at 2.7 bunionectomies an outpatient procedure?

NEAL KON, M.D.

I don’t know. I never did a bunionectomy. I think it’s more complicated, though. No offense to a podiatrist, but I think it is.

A. ROBERT CORDELL, M.D.

How is the porcine aortic root more beneficial than a Dacron root? I had a Dacron root replacement in 1999 along with a St. Jude aortic valve performed at Duke University.

NEAL KON, M.D.

I think the biggest difference is that this is a tissue and you don’t have to take Coumadin, #1. #2, this particular prosthesis has better hemodynamics than the St. Jude mechanical valve and the fact that it’s a natural valve, three valve leaflets, and is indistinguishable in flow patterns from a normal human aortic valve. Now, all that said, a mechanical valve conduit probably has...this has twice as much chance of needing reoperation in the general population, but for this particular patient, since he is 75 years old, I think it’s highly unlikely that he would need reoperation.

A. ROBERT CORDELL, M.D.

This patient is 68 years young and had an aortic stainless steel valve replacement 11 years ago, on Coumadin, of course. How long do you think this valve can last? Thank you very much for your time.

NEAL KON, M.D.

I don’t think I can answer that question for him.
A. ROBERT CORDELL, M.D.

We don’t really know what kind of valve you’re talking about in terms of stainless steel, so it’s difficult to talk about longevity or function of that prosthesis. If you can tell us the name of your valve it would be easier for us to answer.

NEAL KON, M.D.

I think one concept, though, that people have is that a mechanical valve lasts forever or that they need a reoperation. I think if you look in the literature, the incidence of reoperation is certainly less with the mechanical valve than a tissue valve, but it’s probably ½ the incidence, so there are lots of reasons why you might need a mechanical valve replaced, other than a mechanical failure of the valve. They get tissue in-growth. They can form thrombus on them. They can become infected. They can pull apart from the heart and have perivalvular leak. So it doesn’t necessarily mean, if you have a mechanical valve, that you’ll never need a reoperation.

A. ROBERT CORDELL, M.D.

Another question. This patient, today’s patient, was an active male. After the surgery, how long will it be before he can become active again in sports and regular activities? We talked about this a little bit earlier and would estimate that it probably will be at least 6-8 weeks before he’s ready to undertake any significant sports. He can go into regular exercise activities of a relatively mild degree after 3-4 weeks. Walking, which could be considered a mild exercise, can be done safely after a period of 7-10 days. In fact, most of these patients are up, walking in the hospital, prior to leaving the hospital. Any comments, Dr. Kon?

NEAL KON, M.D.

No. We’re getting ready to sew the right coronary on. We’re removing some of the sinus tissue on the porcine root. You can see this coronary matches up quite nicely and it’s quite mobile, so we’re not anticipating any difficulty with it. We’re going to sew this also, just like we did the other, end-to-side 5-0 Prolene continuous suture line.

A. ROBERT CORDELL, M.D.

Another question. Please comment on robotic surgery when used, how practical, advantages and disadvantages. Thank you.

NEAL KON, M.D.

Well, we’ve got a potential expert in robotic surgery, Dr. Kincaid. Do you want to comment?

EDWARD KINCAID, M.D.
Robotic surgery is really just beginning in the realm of cardiac surgery, but there are some accepted procedures where the benefits of robotics are proven and that would be a mitral valve repair, which is really the typical operation right now that the robot can be used for. The advantages of using a robot for that procedure are that the incisions used are much smaller, it does not require dividing the sternum, and the exposure obtained with the robot is excellent. For other cardiac procedures, the potential really is unlimited, but it’s going to take time and effort to figure out the best way to do an operation with the robot. This would be one of those, an aortic valve replacement or an aortic root replacement. The techniques of that have not been worked out with the robot yet, but I’m sure somebody will.

A. ROBERT CORDELL, M.D.

I haven’t heard any mention of retrograde cardioplegia during this cross clamp. Are you using retro or antegrade cardioplegia? I think throughout our entire department we use retrograde cardioplegia and have for many years. We feel that it has many advantages and this patient had retrograde cardioplegia. It’s being given about every 20 minutes in order to protect the myocardium.

Another question: Why do use slush? We use slush because we feel that it’s safer in terms of maintaining a low temperature for the myocardium or muscle of the heart wall. We did temperature studies as a routine for many years, with constant measurement of the myocardial temperature in between the giving of further cardioplegia, which as I’ve said, occurs about every 20 minutes, and we found that there was a tendency for the myocardial temperature to rise during that time, which we tried to avoid by using slush. We have not seen, to our knowledge, any ill effects from its use.

The prosthesis is 29 mm in diameter. What’s the Teflon ring diameter? Would you folks estimate 30 or 31?

NEAL KON, M.D.

The prosthesis is 29 and that is external. That’s the outside. So we make the ring 29 also.

A. ROBERT CORDELL, M.D.

It works out to be perfectly fine because of the fact that the Teflon felt is not only compressible, but it also stretches out nicely if need be and it works out well.

Question: Does the flesh grow and bond to the artificial valve? I ask because I am curious about the sealing and if any leaks occur.

NEAL KON, M.D.
For prosthetic material, glutaraldehyde fixed tissue, which is what the aortic wall is and the leaflets are, really inhibits tissue in-growth, so you don’t get much tissue in-growth around this. The Dacron portions, where there’s Dacron, that promotes tissue in-growth, so for this, where we want to promote tissue in-growth, basically, is where the suture line is to the heart because the prosthesis is made of Dacron. Areas like where you sew a coronary anastomosis, you don’t want a lot of tissue in-growth. You want nice smooth blood flow. The glutaraldehyde inhibits tissue in-growth there.

We’re just finishing up the right coronary anastomosis and then we’ll sort of contour the aorta after this.

A. ROBERT CORDELL, M.D.

Alright, in view of the fact that it seems like a good time, I’ll try to remove a few more of these slides.

NEAL KON, M.D.

Let me show you one thing before you do that, Bob. That is we’re getting ready to put this back together. You know, the ascending aorta has a natural curve to it, so we’re going to try to reproduce some of that curve now by contouring, cutting a little bit down off the back of the bioprosthesis and make that shorter and then we’ll cut this Dacron graft in a similar fashion, make it a little bit shorter, and I believe we’ll end up with a nice contour. We’re going to put this back together. Once we do that, we’ll be done with the reconstructive part of the surgery.

A. ROBERT CORDELL, M.D.

The current slide deals with conclusions, which we think are well spoken here, that there are fundamental hemodynamic differences between stented and stentless, that there are lower pressure gradients and larger external orifice size with them. There is, I think, a greater tendency or expectation of left ventricular mass reduction or regression. We are well aware of the fact that left ventricular hypertrophy after the usual aortic valve insertion leads to late congestive failure. In this instance, we expect and hope to have improved survival of these patients. We have potential benefits for the small aortic root with prevention of any mismatch and we expect to have increased durability, but we do not know, of course, beyond 8-10 years, since as I mentioned earlier, we are now seeing increasing numbers of patients who are 10 years out after the insertion of this kind of aortic root and we’ve been extremely pleased with them so far. Who knows what will happen over the years, but we are seeing them all annually and we do annual echo studies, as well as histories and examinations on them in an attempt to closely follow their progress and to detect any kind of problem, should it exist.

Another question: How often do you do this procedure? Well, of course, it’s like any other operation; it varies a great deal, but we have done a total of around 1,000 root replacements in the past 11 years. At the moment, it would appear that we are doing
increasing numbers of patients requiring or having this kind of total root replacement, to the tune of, I would estimate, 4-5 per week on some occasions and sometimes perhaps a little more.

This patient had bypass surgery on 9/11/02 and he wants to know if the bypasses could be leaking. Well, we don’t consider bypasses as leaking because they are tubes through which the blood flows, usually from the aorta into a coronary vessel, so they are highways through which hopefully more blood can flow. In fact, we want them to be sure and leak through the vessel, but nevertheless, if you mean if they could be ruptured or could break down, certainly they can. It’s very rare that they should rupture. More likely that they could develop some atherogenesis or partial blocks due to clotting or to increased hardening of the arteries, which would lead to some alteration in their blood flow.

Question: Why did the surgeon leave the commissures standing outside the prosthesis? Well, he didn’t leave the commissures standing. The commissures were left open temporarily in order to help serve as guides for the initial suture placement at the level of the ring below that level. Then they were trimmed off because of the fact that the root has its own commissures inside and it has a circular ring at the bottom of it or proximal portion, which you saw sutured to the patient’s annulus.

I had a mechanical aortic valve replacement three years ago. My surgeon said he had to put in one size smaller valve because the aortic opening was small. I am on Coumadin. Is the smaller valve going to cause you future problems? Well, ma’am, we don’t really know if it will or not because we need to know what the size was three years ago, what kind of valve was put in, and what the estimated opening of that valve is in place. That could be estimated pretty well from ultrasound studies, which perhaps would be worthwhile because at the same time the doctor, the cardiologist doing the study, could also estimate with some accuracy what the pressure is across the valve and therefore help to answer your question as to whether it’s going to cause any future problems.

Question: Would you insist on root replacement in a 77-year-old female with an ascending aorta of 7.5 cm, enlarging without AI? I am sure we would not. As long as your aortic valve is functioning, we would certainly not want to do anything to it, but obviously you sound as if you would need an aneurysm removal of the ascending or transverse or both aorta, which is a tubular type of procedure which is somewhat similar to what you’ve seen today, but not involving the valve.

The lady who previously asked us about her stainless steel valve says that her valve is a St. Jude valve. That valve nowadays and has been for some years...additionally it did have some steel in the ring and the overall structure, but that hasn’t been true for a long time. It’s constructed primarily out of what we call pyrolite carbon, which is a black, shiny, very hard substance which has functioned extremely well, with we think less likelihood of clot formation and future problems. However, it is still a mechanical valve and it still requires Coumadin.
What are the advantages of a St. Jude valve and why does a porcine valve only last 10-12 years? Well, Steven, the advantages of a St. Jude valve are that it does function relatively well. It works well mechanically. It does tend to, in many instances, have a very long life span or durability. That’s not to say that it doesn’t also cause potential problems with clot or fibrous tissue buildup around it, which interfere with it working. You say when a porcine valve only lasts 10-12 years. Some of the earlier porcine valves, which were stented valves, mostly, almost all of them, were stented valves and still are. Many of them did only last 10 to 12 or 14 years, depend on where they were put in, whether it’s aortic or mitral or tricuspid. However, the valve that you’re seeing today is a total root with the valve inside the root, which has been prepared in a different fashion from the way the other valves were prepared and which is thus far holding up extremely well at 10 years, so we simply don’t know what the life span of this valve will be. We hope it will be much longer than that period of time, but we are observing it regularly to see.

A question: Was this patient’s first valve operation? I presume you mean had this patient had a previous valve operation. The answer is no.

The other question is can you have another one later? The answer to that is yes. These aortic roots can be removed, as we have done here, when necessary. Fortunately for the patient and for us thus far, it’s a rare procedure. It’s only been done a few times, but it’s been done successfully during those times and a new root has been inserted, so it does not burn bridges from the standpoint of having another operation at a later time.

NEAL KON, M.D.

We’ve just taken the cross clamp off and we’ve restored blood flow.

A. ROBERT CORDELL, M.D.

The little tube that you see there is for air removal.

NEAL KON, M.D.

I’m just taking a look around. None of these suture lines are bleeding any, which is nice. We just put an air vent in. We displaced the air out of the heart first and took the cross clamp off. We’ve essentially finished the reconstructive portion of the surgery now and we just need to wait for the heart to recover, which will take some time now that it’s getting blood flow again.

A. ROBERT CORDELL, M.D.

If we’re about ready to close, I’m sure all of us and certainly Dr. Kon would be happy to try to answer any further questions. If you would like to send them in, if you would sent them to Dr. Neal Kon, Chairman, Department of Cardiothoracic Surgery, Wake Forest University Baptist Medical Center, Medical Center Boulevard, Winston-Salem, NC, 27157.
We’re going to close now. I’d like to thank everybody for tuning in and viewing. Certainly ask us any questions anytime or let us know anything about your cardiac problems and we’d certainly be happy to answer, both surgeons trying to do this operation or patients who might be candidates for it. Thank you.

This has been a total aortic root replacement using the Freestyle stentless porcine aortic root bioprosthesis, performed live at Wake Forest University Baptist Medical Center in Winston-Salem, North Carolina. The presentation is a continuing medical education program. For those viewers who registered for CME, click on the slide in the window to your right to take the post-test now. Physicians who would like more information or to make a referral should call 1-800-277-7654. Patients who would like more information or to make an appointment should call 1-800-446-2255. The Medical Center is the home of Brenner Children’s Hospital, the J. Paul Sticht Center on Aging and Rehabilitation, a National Comprehensive Cancer Center, a Women’s Center of Excellence, a Pepper Center for Older Americans, a comprehensive epilepsy center, and the state’s only level 1 trauma center for both pediatrics and adults. This live presentation represents Wake Forest University Baptist Medical Center’s ongoing efforts to bring the latest in medical developments to the care of our patients. For information about future webcasts or to view an archived version of this program, visit our website, www.wfubmc.edu.