AORTIC VALVE REPLACEMENT AND AORTIC ROOT ENLARGEMENT
SEQUOIA HOSPITAL, REDWOOD CITY, CALIFORNIA
Broadcast December 7, 2004

NARRATOR

Each year over 100,000 Americans undergo aortic and mitral valve surgery. The latest generation of bioprostheses has been shown to provide excellent hemodynamic outcomes and lasting durability. They also allow patients to live active lifestyles without the risks of anticoagulation therapy. During this live webcast, surgeons from Sequoia Hospital in Redwood City, California, will present innovative surgical techniques for the management of the small aortic root by performing a small incision aortic valve replacement.

VINCENT GAUDIANI, M.D.

We like to show how we do this simple operation to enlarge the outflow tract and give the patient optimal aortic valve size. The final most important thing to do is to replace that valve with a valve that’s big enough to give the patient the opportunity not only to have normal flow at rest, but to be able to at least exercise moderately.

NARRATOR

At any time throughout this program, you may email questions to the physicians by clicking the MDirectAccess button on the screen.

LUIS CASTRO, M.D.

We’re happy to be hosting this live webcast for you. If anyone is not familiar with this format, you can submit emails to us with questions by using your MDirectAccess button located on your screen. We’re going to try to answer as many questions as we can during this live format and we’ll be answering questions up to a year from this date. My partner, Dr. Vincent Gaudiani, will be performing aortic valve replacement incorporating aortic root enlargement to maximize left ventricular mass regression in a 52-year-old woman who had a lower mini-sternotomy. This patient has severe aortic stenosis secondary to a bicuspid aortic valve. Now let’s go to Dr. Gaudiani in the operating room.

VINCENT GAUDIANI, M.D.

Hi there. I’d like to welcome you. You’ve already met my partner, Dr. Luis Castro. If you want to find out what happened in the Scott Peterson murder trial, you logged into the
wrong part of Redwood City. That’s the superior court. You’re here in an operating room down the street a ways, where we’re doing aortic valve replacement. As we do nearly every day, I have the pleasure of working with, at the head of the table, my Chief of Anesthesia, Don Keating. Across from me is my other partner, Dr. Leopold, who leads our effort in Monterey. To my right is my P.A., Ed Hahn. Next to me is Ms. Ginny Martin, our scrub nurse. We’ve all worked together for many years. Our Chief of Cardiac Nursing is around somewhere, Donna McKinney. What we have here, as Luis probably mentioned...I apologize, I wasn’t listening...is a woman in middle age who has aortic stenosis because she was born with a valve that only has two, rather than three, cusps, the right superior pulmonary vein, so we’re going to replace her aortic valve. Now, oftentimes a woman like this would choose a mechanical heart valve, but this woman has had numerous difficulties with brain operations in the past and we’re afraid for her to be on an anticoagulant, as she may need further brain surgery in the future, so she elected to have a tissue valve put in. Right now I’m putting a vent in the left atrium and left ventricle so that we can keep the heart nice and dry while we work.

So our plan here is to get this heart nice and cold. We just stopped it. We’re giving it ice cold blood. Luis, did you want to slay something before we open this aorta?

LUIS CASTRO, M.D.

Sure. When we consider replacing the aortic valve for aortic stenosis, these are the thought processes that come to mind. The purpose of aortic valve replacement for AS is left ventricular mass regression. #2, from a surgical standpoint, replacing the aortic valve using an inadequately small valve recapitulates the problem we came to treat, so trading severe aortic stenosis for moderate to severe prosthetic valve stenosis does your patient no good at all. #3, the prosthesis, as Dr. Gaudiani alluded to, should be chosen by the patient after a thorough discussion with the surgeon. Let’s go back to see what Dr. Gaudiani is doing.

VINCENT GAUDIANI, M.D.

I’m going to open the aorta now and show them around. Here’s the cut in the aorta. It’s not bleeding because there’s a clamp on above it, which you may or may not be able to see. This woman is a medium sized woman. We cannot put a small valve in her. We want to make sure we put a big enough valve so she can pump enough blood through it without obstruction so her heart doesn’t have to work too hard, so she can carry out all of life’s work and all of its pleasant activities as well and that means putting in a valve that’s big enough, so the operation we’re going to show you is an operation that was first done probably 30 years ago, but it’s never been a very popular operation because some people found it a little harder to do and actually other people don’t think it’s worth doing. There are some people who think it doesn’t matter what size aortic valve you put in. We don’t fall into that group of people. We’ll show you this aortic valve in one second.

That voice you hear in the background, we have several perfusionists here. These are the people who run the cardiopulmonary bypass machine, a critical part of the team. We’re
just busy so I didn’t introduce them. I’ll try to introduce them to you later. Remind me to do that, will you, Luis?

I don’t know whether you can see this valve or not. Can you guys see this? Look, this is a big old calcified ugly bit of badness and it certainly is nothing like what a valve looks like. In a few moments, we’ll show you what a normal pig valve looks like. For those of you who have been around a while, you’ll realize they’re identical to human valves for both physiologic and metaphysical reasons. We’re going to cut this valve out and then see if we can put a big enough valve in to relieve this woman’s symptoms of left ventricular outflow tract obstruction.

There’s a piece of it. Can you see it on the head camera? See this calcified junk? This calcified stuff causes strokes in people, so we’re very careful not to leave it in her. You can stay on the head camera. I can hold fairly still. If it’s bad video, just yell at me, but I have the best view of this now...at least I better have the best view.

The minimum valve size for this woman, for those of you who are familiar with aortic valve replacement, is 23. We wouldn’t want to put a 21 valve in a woman of this size, at least a 21 porcine valve, because although it would be better than what she has now, it wouldn’t be as good as what we can do.

Now, there’s all this calcium around the edges. You can see it. It’s this whitish yellow stuff. If you’re looking through my head camera, the stuff I’m grabbing with the forceps, this is nasty material. Now, in terms of the actual way we do the procedure, we already know what size valve we want to put in there, so if this sizer doesn’t fit right and it’s too tight here, we’ll just open up her left ventricular outflow tract to allow it to become big enough to admit the valve we want. We do that simply by extending this cut that I made in her aorta right down through the junction of the two leaflets, the one to the left and the one to the right here. Some people are concerned about the roof of the left atrium, which you see me bumping away here with my scissors. Can you cut the roof of the left atrium? Most of the time, the answer to that question is no.

So once you get that thing open, the way you see it is here, for one thing, we have much better exposure, so we can see better and we can put a bigger valve in and that may be of value to this woman, although that’s not proven. That’s just what we think. We think that the reason we came here was to put the largest possible valve in this lady so that she would be able to exercise and pump as much blood as she wanted to. There are some techniques that would allow us perhaps to put even a bigger valve in, but they’re somewhat more involved to perform, at least for some of us, so this is a compromise of a simple, quick operation that gives an excellent long-term result and one that’s not too hard to do.

So the next thing we’re going to do is patch this little cut that we put in. In order to do that, we need to take a piece of graft material and cut a flame-shaped section of it. What I’m going to do now is simply sew this in such that the welt is on the inside. There’s the first stitch. If you tell me when I’m on the head camera, I can hold my head fairly still so
you can see what I’m seeing all the time. The head camera’s on? Okay, then I’ll just keep
my nose in the field here and you can experience this the way I’m experiencing it,
basically. You’re seeing precisely what I’m seeing. This camera is like a gun sight
between my eyes, so you’re seeing the operation just the way I do it.

Now, we put in these three sutures and then we drop this patch down in there. This is just
to hold it in place while I put the next 20 or so sutures in, which takes about five minutes
or maybe a little bit longer. You can see I’ve just lined these up so it’s easy to sew and
I’m looking right down the pipe at this now. This kind of sewing is not too taxing if you
happen to do what we do for a living. This is not what we’d call hard to perform, but
what it does is this gusset will now enlarge the place where the valve goes and we’ll be
able to put a size larger valve in, sometimes as much as two sizes, but I think it’s safer to
say this technique is really good when you want to go up one valve size. If you want to
go up two, the best thing to do is probably put a stentless root in, which is the way I like
to do them. In fact, if you’re interested in that operation, my colleague and friend, Neil
Kahn, did one for OR Live a few weeks or months ago. You can look at the two
operations, this one and the one Neil did, and you’ll be able to learn about two really
good techniques for doing aortic valve replacement that are useful and that have proven
themselves. My partner, Dr. Castro, who has been speaking with you, has written up a
series of about 150 of them that we’ve done and we’ve now done well over 200 of these
out of about 1,500 aortic valves in the last six years or so. Of all the aortic valves we do,
about 20% of them will involve outflow tract enlargement in order to give what we
consider to be an optimal operation. Another 5% or 8% will be aortic root reconstruction,
such as the one Dr. Kahn did, again for a variety of reasons, sometimes to enlarge,
sometimes because it’s a better operation for people who have endocarditis.

Now we’re sewing the other side. We picked up a suture that also has a needle on it and
will sew in the other direction. You’ll notice, again if you’re an operator, you’ll notice
that I’m taking very good bites. These sutures are very important and it would be hard to
get back here if they’re put in wrong, so they have to be done vigorously. Does that show
up well, Luis?

Then the next thing we’ll do is take back that sizer and see if it fits any better now. Okay,
so now we’ve sewn in the bottom of this gusset and we’ll use the rest of it to close this
hole when we’re all done, but now I guess we better replace the aortic valve, so we’ll test
the sizer again and it fits beautifully. From the time we stopped the heart to stopping
giving retrograde, that is stopped giving the solution to the heart that keeps it still and
quiet and happy while we’re working, only nine minutes have gone by, so the technique
I’ve just shown you doesn’t add a lot of time to the overall time of doing an aortic valve
replacement. I believe in a paper that Luis published that it averaged about 12 minutes.

I should also mention that we’re operating through a lower mini sternotomy. That is,
about the lower half of the normal incision. We do that in women, in particular, because
if you want to wear a golf shirt, you don’t have to advertise that you have had a heart
operation. There are actually some better cosmetic operations for mitral surgery that we
use. We’ve done about 500 aortic valves using these smaller incisions and about 300
mitrals, so it’s a nicety. The most important thing, though, is to get a good, proper sized aortic valve in.

Well, we’ve done the first third of this annulus. Now I’m going to go across this patch. Oftentimes I’ll do this with pledgetted sutures from the outside, but in this case it’s so nice that we’re just going to put a greenie without. So now we’ve crossed the boundary of this gusset that we’ve put in the left ventricular outflow tract to help us enlarge it so we could put in a larger valve, the purpose, again, of the larger valve being to give the woman...remember that resistance to flow has to do with how big a hole you have. For instance, it’s a lot harder to breathe through a straw than it is to breathe through a vacuum cleaner tube because that straw is so small. Similarly, it’s harder to pump blood through a small hole than it is through a large hole, so we want her to use her heart to pump lots more blood, not to pump against the heavier resistance, the worse resistance.

Now we’re going to finish around here. Luis, cut in any time you want because we’re just putting in sutures here. You’ve got about another four minutes.

LUIS CASTRO, M.D.

We’ve got actually some email questions that are coming in. The first one, Vince, I thought you might be interested in. What is the youngest patient into whom you’ve placed a porcine aortic root?

VINCENT GAUDIANI, M.D.

The youngest person we’ve placed porcine valves in, the youngest actually is 22. This is a woman who wants to have babies and is not yet married. There are lots of other operations to do. Some people would have advised the Ross operation, instead of using the pig valve, the person’s own pulmonary valve is used in the aortic position to replace their bad aortic valve and then a dead person’s pulmonary valve is used to replace the now utilized pulmonary valve of the patient. That’s a great operation in children and it may be a great operation in other people, but there’s no strong data yet that this operation is actually any better or any safer than the pig valve operation. I could do the operation in the young woman that I did through an incision this big in two hours flat and it’s true she may be back in 8 or 10 years, but in that period of time, god willing, she will have been married, have her babies, and who knows what will be available in 10 years. I think if you like this strategy, it’s the 10-yard pass, the 12-yard pass strategy, rather than going for the bomb. In general, over the years in surgery, our philosophy is that patients are better off with less dramatic operations because of the capacity of larger operations to have technical failure. So she’s the youngest. We’ve put them in many people in their 30s, particularly police officers and people like this.

What we’re going to do now is give more cold blood to the heart to allow it to recover some of its function and keep it oxygenated while it’s stopped. We want to make sure that we wash any little bits of debris that we’ve left in the heart out because any of that debris left in would cause her to have, if it got free into her brain, once her heart was
beating again, it would obviously be a source of having a stroke, so we’re very, very assiduous about removing any particulate debris.

LUIS CASTRO, M.D.

We have another email question that just came up, Vince. It says here, could you do this operation with the patient awake, like Mr. Amrani in Herrfield, UK?

VINCENT GAUDIANI, M.D.

Before I answer that question, let me just show you what a beautiful normal valve looks like. This is the underside of a human valve. Look, you can see one, two, three leaflets. You’ll notice it’s perfectly round. Three leaflets is the smallest number of leaflets that allows you to have a perfectly round valve, so the grand designer chose this design because it’s the “easiest engineering” for the maximum round result. 4, 5, 6, 7, and 8 leaflets would have been even rounder, just like the iris on a camera, but the engineering would be harder. Two leaflets isn’t enough. You always have an oblate opening with two. This is from a pig. This is the mosaic heart valve, which we think has the best tissue technology right now. What we’re going to do now is thread the sutures that we put around the edge of her annulus onto this little sewing ring, then drop the valve into position and go home.

Now, did someone ask if they could have their aortic valve awake?

LUIS CASTRO, M.D.

Awake like they did in the UK.

VINCENT GAUDIANI, M.D.

Ah. The question, I guess, really is did they want to do it awake because they ran out of anesthesia or because there was some advantage to being done awake? What do you think, Luis?

LUIS CASTRO, M.D.

I’m not sure. I’m not familiar with this patient in the UK.

VINCENT GAUDIANI, M.D.

I read about it in the newspaper. To be honest with you, whoever the nice person is who asked this question, there’s no science about doing major surgery awake yet, but in general, what we know about the effects of what we call trauma...trauma means different things to surgeons, like we caused trauma to this nice lady that we’re operating on by making this incision in her. It’s a traumatic event. The main thing anesthesia does, besides render her pain-free, is it reduces the extent to which her body responds to
trauma, so if I took a saw and went at your chest the way I went at this lady, with you awake, you would not only have a great deal of pain, but you would send to your body a huge number of incredibly powerful stimulatory messages that something terrible was happening to you. Anesthesia blocks all those and thereby the heart doesn’t get so excited about them.

I read in the New York Times about this, but I thought it was a bad joke. Maybe there’s something profound to it that I’ve missed. I think we’ll let the English do this for a while and then, if it turns out to be something really good, we’ll get rid of our anesthesiologists, which as I said to Dr. Keating only 400,000 or 500,000 times is something I’d like to do, but I’ve just never been able to manage.

LUIS CASTRO, M.D.

I’d like to talk about why we think bigger valves are better. We think bigger valves are better in most patients after aortic valve replacement. This is explained by Pozulla’s law, which essentially states that resistance analogous to LV work is inversely proportional to the fourth power of radius of the aortic size, so even a small increase in aortic valve size creates a tremendous reduction in left ventricular work. That’s probably why even small size valves in most people do some good at all.

This is important work done by Drs. Blais and Dumoneel and Peberow in Canada at the Quebec Heart Institute, where they looked at the prevalence of mismatch in their patients after aortic valve surgery and its effect on early mortality. They looked at a 10-year period where they had 1,200 patients. Their incidence of mismatch in those patients, as defined by an indexed effective orifice area less than 0.85 was 38%. Their overall mortality was 4.5%, but if they looked at those patients that were not mismatched, the mortality was 3%. If you were moderately mismatched the mortality was double at 6%. If you had severe mismatch or indexed EOA less than 0.65, your mortality was 25%.

They then examined...this is the most important slide...the significance of a sick heart or left ventricular dysfunction in the presence of mismatch. If you look at patients with moderate mismatch and you look at risk ratios, mortality risk ratios, if you have moderate mismatch, your ratio went from 1.8 to 7.1. In the presence of severe mismatch, your mortality ratio went from 11.3 to 77.1, so even the sickest hearts, or the sickest hearts, period, need the biggest valve possible. We really don’t think that the heart knows what kind of valve you put into it. All it sees is the hole that you’ve created with the aortic valve replacement.

Now let’s go back to Dr. Gaudiani and see what he’s doing in the operating room.

VINCENT GAUDIANI, M.D.

I’m about two seconds away from dropping this thing down in. We have two stitches to put in, Luis, and then we’ll be ready. I want to adjust one of them here and then we’ll be ready to put our last stitch in. So now what we’ve done is we’ve put in the gusset and
we’ve put in the sutures that we need around the aorta and we’ve put those sutures in through the valve as well. You can see that right here. I’m putting the last one in right now. Then we’re going to drop this valve into position and tie it in place and that’ll be all for this operation. These operations now, in an easy case like this one...obviously we didn’t choose the toughest case in the world to do for this performance, so you would be able to see the basics. This can be done under much more difficult combat circumstances than the one we’ve chosen today. This is a boutique kind of case. So what I’m doing now is pulling up on these strings as we drop the valve into position. If you look through the head camera, you’ll see exactly what I’m doing. It’ll give you as good a view of this as I have and once again, you know, I’ve got to have a good view.

Okay, now once we’ve pushed it down with our finger, you can see this blue apparatus is used for holding the valve in a nice position while we work on it. Some people use it to help them tie the sutures, but generally speaking, it’s just what everybody gets used to and I just never got used to this thing, so I take it out of the way and then I look through the valve. One of the things I like about this valve is you can see underneath it, you can see where the sutures are. My partner, Dr. Opal, is pointing out the origin of her left coronary right there. You see that little belly button that he’s sucking across? That’s where your left main coronary artery is. Without that, it’s lights out, so this is a beautiful illustration. This woman has absolutely no coronary disease and that’s one of the reasons we can do her through a small incision. Naturally, the valve has to be seated below the coronary arteries so that normal blood pressure pushes blood into the openings of these coronaries and allows them to work.

LUIS CASTRO, M.D.

(both doctors speaking at the same time)...that size valve is inherently stenotic. In fact, we don’t have them in our hospital because of this reason. This is basic valve sizing or stent valve sizing that we have noted through many operations of actually looking up effective orifice areas in each given valve type. If you’re a small person, this all makes sense from a logical standpoint. A small person can have a small sized valve. A large person needs a big valve because it’s indexed to his body surface area.

As you can see from this slide, a small person weighing 50 kilos or so should have a size 21 or larger. An average sized person weighing 75-80 kilos should have at least a 23 mm valve, or a 23 size stented valve. A large person needs at least a 25 or 27 stented valve. If you can’t put in a stented valve in a routine fashion, that’s when you have to consider doing aortic root enlargement, which you’re watching Dr. Gaudiani do, or aortic root replacement.

Vince, here’s a question that just came in through email. What do you think of using pericardium for your root enlargement reconstruction, instead of Dacron?

VINCENT GAUDIANI, M.D.
This question has come up a lot. Dr. Castro and I have gone around the country various times and, as I mentioned, we’ve written a few papers about this. There’s lots of other things that have been used, bovine pericardium, human autologous pericardium...that means pericardium from the same, as if I cut a piece of this lady’s pericardium out and used it...and these Dacron grafts that we like. We think the Dacron graft is a far superior piece of equipment for doing this and here is why. First of all, because it’s corrugated, you don’t have to get the length perfect, so all you have to do is get the length reasonably right and it will help adjust. Pericardium doesn’t do that.

Second, it has the shape of the aorta. I use the tube graft, not a piece of flat material that’s Dacron, but I use a section of the tube graft so it has the same fundamental structure and shape as the aorta, the same conical or I guess cylindrical would be a better word, shape as the aorta, so I can cut a piece that’s going to fit right into her cylindrical aorta. The third thing is, everything is known about Dacron and it’s very reliable, whereas pericardium, you know, there’s thicker and thinner and it’s not so nice to deal with. It’s not as regular to deal with. So all in all, we never use pericardium. I have fooled with it many years ago and I fell into these collagen-impregnated woven double velour grafts. I think we use the Hemoshield graft, which is just an excellent piece of equipment, and we had almost no trouble with them. Can you think of anything I’ve missed, Luis?

LUIS CASTRO, M.D.

No. I think you made all the important points that need to be made about Dacron. We love it. It’s a much more uniform, more consistent material that allows you to sew sometimes bad aorta to at least a consistent, very reliable, strong fabric material.

You might ask how we choose aortic root enlargements over aortic root replacements. Really, we choose patch enlargement, which was the Manugian. One of the emails was whether this is a Nix operation or a Manugian. This is a Manugian. We divide the commissure between the left and the non sinuses of Valsalva. When you only need one size larger, the root enlargement is a much faster technique. It takes us only 10 minutes to do and many times all you need is one size to get that patient out of mismatch. When you can sew Dacron to the aortotomy, meaning the aorta is severely calcified, it’s not reliable, the worst thing there is sewing aorta to aorta. You’re going to have a serious bleeding problem. When speed matters, we’ve both alluded to that, and when there’s a lot of calcium around the coronary ostia, meaning the root replacement technique would be severely dangerous in terms of bleeding potentials. Here you just put in a patch and put in the stent and valve size that you need and off you go.

VINCENT GAUDIANI, M.D.

I’m going to now...here’s another reason why the Dacron is good, because we just cut this thing as long as we needed to, not knowing how long it would be, and now we’re going to close this. What this will look like when it’s done is the inside of a Saran wrap roll, you know, one of those cardboard cylinders, the inside of a toilet paper roll, for instance, you’ll see how it will just fit in there perfectly, or at least that’s what it should
look like if we execute properly. Now we come to the outside. All this time, I’ve been inverting the sutures. We’ve now been clamped about how many minutes? 38 on the clamp and we’re closing the aorta. Now we’re coming up the other side. We’re just using this patch that we used to enlarge the outflow tract, now to completely close the aortotomy. That’s another change over the original Manugian operation, where I think it was just used at the bottom. We use it to patch the entire aorta open, since it’s a wonderful material and it’s easier to do that than to have a T anywhere where the patch would meet the closed edges of aorta.

Now, once we get about halfway closed, like we are now, we can take this thing and estimate how much of it we need to have left. I’ve just looked at it. You can see where the end of the incision is. Conti will point at it. Right there’s the end of it and I need a little bit less than that, so now I can take this scary looking blade here and cut a little church steeple out of the rest of it, which will represent what hasn’t been closed yet. Although as I frequently joke, the nuns never thought I’d turn out to be much for cutting and pasting. Turns out I’ve made an okay living being able to make simple shapes like this. Then we use exactly the same suture technique, which is one off the apex.

One of the things we do in these cases is if this were a little old lady, you know, a person in their 80s, for instance, with frail tissue, we might well use Cryolife Bioglue on the edges of this. In a 52-year-old, it probably won’t be necessary.

LUIS CASTRO, M.D.

Here’s another email question that just came in. I’m 32 years old with severe aortic stenosis, a valve area 0.62 cm². How complicated is the operation and what are the recuperation rates? That’s a fairly straightforward question to answer. Aortic valve surgery in a young adult, straightforward annular valve replacement with either a bioprosthetic or mechanical valve, should be relatively uncomplicated, meaning the mortality should be almost 0%. Now, if you look at other aortic procedures, if you opted to do the Ross operation, which is a viable option, the mortality in the best of hands is going to be 1%, meaning 1 out of 100 young adults will probably die during and/or around the time of operation, so sometimes the simpler procedure can mean much improved survival rate, though you’re going to have to look, unfortunately, to the likelihood of having to come back for an operation.

VINCENT GAUDIANI, M.D.

The preop echo was so beautiful on this woman and showed the pathology so well. Joni can show them what it looks like after the valve is replaced and she’s got a ton of room to pump blood through. What we’re doing now is just finishing closing it. You can see us just finishing the top portion of this suture line.

LUIS CASTRO, M.D.
At times we use a little bit of Bioglue just to mitigate any potential bleeding from the suture line.

VINCENT GAUDIANI, M.D.

We’re about three minutes from taking the aortic cross clamp off. We’ll show you what it’s like to assess the valve. You can see the heart is holding still in there. This is her left lung. This is her heart, stopped. I don’t like to obstruct too much when people’s hearts are stopped. I want to get this done, even in short operations, as I’ve probably mentioned. So now we’ll go back and finish this with 7-8 sutures here and then we’ll fill the heart up with blood and let it get going again. Once we’re done, it might be interesting for you to be able to see what the heart looks like before the operation and after, as seen through the echocardiogram, which we have used in her. We have an echocardiogram in her esophagus so we’re able to see what the dynamic difficulties are with the valve before and again after the operation to make sure we’re happy with the technical aspects of it.

You see this patch has split, basically, the aortotomy. The opening in the aorta has been split by this patch. When it’s all full of blood, it should look pretty much like we meant it that way. It should look like an organized kind of closure. This, again, is very hard to do with something that isn’t a cylindrical section to begin with. That goes back to the question about why we use this material rather than pericardium.

Now, we’ve hooked up the cardioplegia to the left superior pulmonary vein, so now what we’re going to do is fill the heart up with blood, using the vent as an introducer of blood. That’s just to bubble air out of the heart because air, like debris, causes...

So we’re using these two little instruments here to squish the heart a little bit to help massage air out of it while it’s still stopped. Now I’m going to physically shake her body, which you can see from the camera above, if you go back to that. These are all maneuvers to get air out of her. Head down, please. Her heart is already beginning to reacquire tone. I can tell just by feeling it. Head down. Clamps off.

LUÍS CASTRO, M.D.

48 minutes. So the operation was done, aortic valve replacement and root enlargement, in 48 minutes, which is about average for us, about 50 minutes.

Dr. Peberos submitted an email to us. The impact of mismatch, I’ll just read it for you, is particularly important in patients with poor ventricular function. We agree with that. This is the type of patient where you want a nice free outflow tract, so you want to completely avoid mismatch. This is also the type of patient where you want to have a fast operation and reduce as much as possible aortic cross-clamp time. How much extra time does your root enlargement procedure add to the bypass time? Would you recommend this procedure in patients with poor left ventricles? As you saw, Dr. Beroa took probably 10-12 extra minutes from an aortic valve replacement that probably would have taken 38 minutes cross clamp time. We think the sickest ventricles are the ones that need the
biggest holes. If they’ve got a large aortic root to begin with, a large stented pig valve or mechanical valve or root replacement should suffice. If they have a small root, those are the patients that you don’t want to mismatch. We have an algorithm for that too. Here, our valve sizing changes completely. A small person now needs at least a 23 size stented valve. An average sized person, we jump up to a 25 valve. The biggest patients with the sick hearts clearly need a 27, 29, or a root replacement to get them out of the operating room, to have them return to quality of life. That’s our strategy. A lot of it is based on the work that our friends from Canada have done.

VINCENT GAUDIANI, M.D.

We have a tube in her heart here that I’m removing to get the debris out of the way. This is just rigging from a part of the operation that’s over. This tube helped give blood into the myocardium so it would stay cold during the operation. This is retrograde cardioplegia, of course, for those of you who know about such things, and I’ll show you what this patch looks like because this isn’t perfect but this is generally what they look like when we’re done with them and you’ll see it has a sense of looking the way you might presume it would look.

Now, you see how this patch looks? Doesn’t it look like it sort of belongs there? You can see, if you look at my hands now, all we’ve done is unwrapped the aorta. Can you see this gesture by my hands? It’s as if the aorta was like this when we started and we made this incision and put the larger valve in and then put the patch in, the aorta’s now like this. It’s been unwrapped, just the way you would a Saran wrap roll. So when we finish it, it has that finished look about it. It doesn’t look accidental. It looks like we meant it. It’s very easy to do, as you can see. 48 minutes is not a long time for an operation like this and maybe we would have done it in 38 minutes had we not had to do this, but she’ll get more value out of this operation than she would out of a smaller valve and certainly for us the purpose is to provide value to the patient. Those people who say they can’t figure out why we bother to do this must think that there’s enough value in any improvement in the aortic valve size, and perhaps that’s true, but until that’s proven conclusively or until it’s falsified that large valves do better, we’re going to continue to put the larger valves in patients.

Now in just a minute we will come off bypass and we’ll show you the heart beating again and then we’ll show you some interesting video of the echo before and after and you’ll see what was wrong with the valve.

LUIS CASTRO, M.D.

You can see that with her body surface before the operation, she was a minimum valve size to give the patient at least 0.85 cm²/m² of valve area, so we know what minimum size valve we’re willing to put in a patient before we’ve even scrubbed into the operating room. At the time of operation, if the appropriate valve sizer or the annulus is larger, we use that valve size or larger. If the sizer is too big, we decide on aortic root enlargement,
all we need is 1-2 valve sizes to get him/her out of mismatch or aortic root reconstruction, if we need the biggest possible orifice possible.

VINCENT GAUDIANI, M.D.

Now the heart is beginning to beat again, you can see in there, if you’re looking through either the camera or my head camera, as soon as it’s had a little bit of a drink after having been asleep for a while, we’ll let it come up and do the job.

Most of the leaking that you see here now will go away once the patient is reversed. Remember, again, for those of you who don’t do this for a living, she’s been given a powerful anticoagulant so her blood won’t clot while it’s going through the heart/lung machine. One of the things we hope you’ll notice about this, just in a general way, again, for civilians, is that cardiac surgery, unlike some other specialties, the outcome is not the result of a single person’s effort, but it’s a coordinated team effort. Our perfusionists, Paul and Jeff, have to run the pump just so. We need perfect anesthesia. We need great OR nursing. We need great echocardiography. Joan Hardy, our echotechnologist, came in specially to show you this case today, but we have echotechnologists for every single case we do, which is now pretty much the standard of care everywhere and everyone has to act in concert in the patient’s interest. That’s what the center of cardiac surgery is.

LUIS CASTRO, M.D.

Vince, I have another email that just came in. It says I have a 28-year-old male who had a 21 St. Jude mechanical valve put in at age 11. He is now 6’2” and weighs 300 pounds. Would this operation work to implant the larger mechanical valve in this reoperative situation or will he need a cono?

VINCENT GAUDIANI, M.D.

Oh, no, no, no cono. Again, we’d have to see all the information, of course, but I’d go nowhere near a cono to fix that. I’d just enlarge his outflow tract or put a mechanical root in him. Either way, I’m sure we could go up and we should also make sure the writer knows that since he was operated on, the St. Jude valve has managed to thin out its housing, so for the same size structure, you get more hole. Of course, the purpose of all aortic prostheses is to buy the patient a bigger hole, so now they transmit blood more efficiently, the St. Jude Regents valve, so that would be another alternative, put in a 25 St. Jude Regent root and that would be plenty for him. Up two sizes would be plenty. I doubt the 21 he’s got is good enough for him now. The way to find that out is to get him an echocardiogram and see if he has left ventricular hypertrophy. If he has none, then it is okay. If he has left ventricular hypertrophy, you’d think about doing something about it at some point.

Now the heart is beating. You can see it has filled up. Don Keating has the lungs on. You can see her lung just peeking through here on the left, again if you’re looking through my head camera. Don, what’s her blood pressure? Her systolic blood pressure is 120. That’s
pretty fair. Now we’re going to take the vent out that we were using to drain extra blood out of the heart. Again, if you’re looking through the head camera, you’re seeing just exactly what I’m seeing.

LUIS CASTRO, M.D.

We always think that implanting a valve, implanting the biggest size valve, is done with a supra-annular position so the pledgettes are always on the ventricular side, coming out to the aorta. It’s the only way you’re going to get in the biggest size valve.

VINCENT GAUDIANI, M.D.

You’ll notice this little white wire here is an external temporary pacing wire. For those of you who aren’t familiar with this kind of work, this is something that’s a standard of care for all patients who have heart operations, at least in our hands, and I think in everybody’s hands. It’s just a way of maintaining heart rate until her own heart rate decides it wants to be proper.

Show them the echo. That’s the new one? Good. You see how big that is, everybody? With your finger, show them how the blood flows in and out of the heart, Joan. Just show them where the mitral valve is, with blood going in.

LUIS CASTRO, M.D.

As you can see, the valve is perfectly positioned in the annulus. It’s not tilted at all, so we truly believe that incorporating this strategy to maximize LV regression by eliminating mismatch will benefit your patients tremendously. What we’ve seen today is Dr. Gaudiani performing aortic valve replacement, incorporating a root enlargement to again maximize the aortic orifice, minimize or eliminate mismatch, all done through a lower mini sternotomy.

We thank you for viewing this webcast. We’ve had a lot of fun.

NARRATOR

This has been a live webcast of a small incision aortic valve replacement from Sequoia Hospital in Redwood City, California. For more information, click the buttons on your screen.