MINIMALLY INVASIVE MITRAL VALVE REPAIR
NEW YORK UNIVERSITY MEDICAL CENTER, NEW YORK, NEW YORK
Broadcast March 9, 2005

NARRATOR

Approximately 60,000 patients require some form of mitral valve repair each year. During this live webcast, surgeons at NYU Medical Center’s Department of Cardiothoracic Surgery will perform a minimally invasive mitral valve repair procedure.

STEPHEN B. COLVIN, M.D.

Instead of opening up the rib cage to do the operation, we’ll be sort of sneaking in between the ribs to do the valve repair.

NARRATOR

NYU’s minimally invasive approach for mitral valve surgery provides several important benefits to the patient.

STEPHEN B. COLVIN, M.D.

We’re doing the surgery so that people can get back to a full and active life with less shortness of breath and less fatigue than they usually have when they have serious mitral insufficiency.

NARRATOR

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

AUBREY C. GALLOWAY, M.D.

Welcome to New York and to New York University Medical Center, where we are sitting outside the operating room and we’ll be performing a mitral valve repair operation today. The operation will be performed by Dr. Stephen Colvin, who is Chairman of Cardiothoracic Surgery at NYU. I’m Dr. Aubrey Galloway. I will be your moderator and will field questions that you send in through email, and Dr. Eugene Grassi, who is Professor and Head of Cardiac Surgical Research in our program, will be the director of the program, will be fielding the questions and feeding them to me so we can interact with you throughout the procedure.
Today’s patient that we’re operating on is a 54-year-old man with severe mitral valve insufficiency. The patient is asymptomatic and has good left ventricular function, but because of a possible survival benefit and because of the amount of volume load on the ventricle, we recommended that the patient undergo mitral valve repair. I would like them to roll the tape to show you where we are in the procedure up to this point and I’ll show you some of the echo and data that has occurred up to now.

This shows that the patient obviously has good left ventricular function. This is an echo done in the operating room with the patient asleep. The mitral insufficiency is quite severe, with a posterior leaflet prolapse that is seen there, on that echo. The jet was directed posteriorly and anteriorly and was a quite wide jet. Our experience over the last 8-9 years has been that virtually all isolated valve operations can be done with a minimally invasive incision. Here you see Dr. Colvin performing the typical skin incision, which is made beneath the breast, in the inframammary skin folds, so that it’s quite cosmetic in females and in all patients is less painful and less traumatic than had we had to go through the breast bone, as we would have in traditional open heart surgery.

This shot is inside the patient, looking at the patient’s aorta, actually, taken from the head camera on Dr. Colvin’s head. This is the exact view that the surgeon sees at the time of surgery. In our early minimally invasive operations, we cannulated for the heart-lung machine on the femoral artery, but in this case, we now cannulate directly percutaneously into the aorta and that’s the overview of the setup that you see there, small incision, percutaneous cannula of the aorta. To return blood to the heart-lung machine, we’re passing a long venous cannula and the surgeon is placing this, looking at the echo. What you see is an echo of the right atrium with the cannula being placed, with the tip of the cannula in the superior vena cavum. That’s a view of that cannula right there that was placed 10-15 minutes ago. Now that the patient has these lines in place, the surgeon goes back and places a catheter inside the heart, into the coronary sinus. We use the echo to place that and this shows the catheter going into the coronary sinus, and that’s how we’ll give the myocardial protectant solution to protect the patient’s heart during the surgery.

Now, since that video, Dr. Colvin has commenced with the surgery. He has placed the patient on the heart-lung machine and has now stopped the heart and is working on the heart. I would like to go live in the operating room to introduce you to Dr. Colvin, who you now see operating. Dr. Colvin, would you please introduce some of the people in the operating room, but more importantly, tell us where you are with the procedure at this point?

STEPHEN B. COLVIN, M.D.

Well, thanks, Aubrey. We’ve opened the atrium after arresting the heart on cardiopulmonary bypass using retrograde cardioplegia. I just want to introduce the members of the team. Dr. Adam Arnowski is first assisting me to the left and Dr. Paul Saunders is opposite me. Ms. Robin Venick is the scrub nurse. Dr. John Jackson is the anesthesiologist and Ms. Carol Lee is the perfusionist in charge of the case.
So at this point in the operation, you’ve already seen the echo that Aubrey has shown you and there’s a large segment of the posterior leaflet, between the middle scallop and the posterior commissural portion, so sort of between P2 and P3, that’s herniating out into the left atrium. I’m holding that segment with my forceps. I have placed sutures superiorly around the superior margin of the pathology and inferiorly marking, denoting the lower portion of the pathology. The rest of the bowel does not prolapse much. The leaflets look alright. The anterior leaflet has a little bit of thickening on it where the jet of blood from this posterior leaflet has been striking the anterior leaflet. You might be able to see a little roughening in the intra-atrial septum, where the jet of blood has been hitting the atrial septum. The treatment for this is going to be to resect this section of the posterior leaflet, do a rectangular resection of the posterior leaflet down to the annulus. We’ll do the same thing superiorly, so the incision is made through the posterior leaflet down to the annulus, and then we’re going to resect the posterior leaflet right flush with the annulus.

Then we’ll assess the height. This section of the posterior leaflet was a little bit high. We don’t want to have too high of a posterior leaflet at the end of the operation, so you can see that I have resected approximately 1.5 cm of the posterior leaflet. Okay, so that’s almost 2 cm of the valve posteriorly. If I plicated the annulus, this section of the posterior leaflet would be a little bit high, so we’re going to do a modified annular plication and folding plasty. We developed the folding plasty to avoid some of the problems associated with mitral valve repair surgery that we’ve previously seen, to minimize the height and prevent any kinking of any of the posterior arteries of the heart.

AUBREY C. GALLOWAY, M.D.

Let me break in while Dr. Colvin is placing some of these stitches in. If we can go to a slide I’ve prepared, again it’s showing a typical myxomatous valve, very similar to the one Dr. Colvin’s operating on, with a very large posterior leaflet that again is often 2-3 cm in length as well as 1.5-2 cm in height. If one resects that posterior leaflet and goes to a traditional repair, which I’ve now shown here, which was described by Carpentier, which is a rectangular resection followed by annular repair, which you see in Part B, repair the leaflet and then annuloplasty, we found in these myxomatous valves that there would be a very high risk of systolic anterior motion after the repair, so rather than go with that type of traditional technique, over the last 10-12 years we have moved over to the technique that Dr. Colvin and our group described here, called folding plasty, where the height of the posterior leaflet is quite high, again, often more than 1.5-2 cm. You have a big, large myxomatous anterior leaflet. Rather than repairing the annulus and then repairing the leaflet, we simply fold the posterior leaflet down onto the annulus until we reach the height that we want for coaptation with the anterior leaflet, and then we complete the leaflet repair.

So to summarize that approach for a posterior leaflet with myxomatous disease, we have been less aggressive with local direct annuloplasty. We’ve done more folding plasty or sliding plasty, which was described by Carpentiere, to lower the height of the posterior
leaflet and lower your coaptation plane. We would say you should fold or slide if the posterior leaflet has a lot of height, as this avoids or dramatically lowers the risk of postoperative SAM, the short term for systolic anterior motion. We always use an annuloplasty after repair in all valve repair procedures, but with myxomatous disease like this, we don’t need to overcorrect with the annuloplasty. We want to use a nice, large annuloplasty band so that we hold our repair in place. Maybe we can go back to Dr. Colvin and he can again comment on how he’s doing this folding plasty and placing these stitches.

STEPHEN B. COLVIN, M.D.

At this point, I’m bringing the superior part of the posterior leaflet down to the annulus with these 4-0 Prolene sutures. I usually use figure 8 type sutures, rather than just simple sutures or mattress, and I don’t use a running suture technique because we don’t want to risk any of the sutures pulling through and compromising the entire repair, so after these last 2 sutures have been placed, we’ll bring together the edges of the posterior leaflet and then we’ll hide them and replace the annuloplasty band. With this technique, you avoid the risk of SAM, you avoid the risk of kinking of the circumflex, and you provide the patient with a much bigger mitral orifice. With the use of our annuloplasty band, the future band, we find that we’re remodeling the valve after we’ve remodeled the annulus so that the repair will stay intact and will be very, very durable.

AUBREY C. GALLOWAY, M.D.

If I could break in for a moment, I noted when we were starting the procedure that this patient was asymptomatic and had severe mitral valve insufficiency. It’s been an increasing understanding of the natural history of asymptomatic mitral insufficiency over the last 10-15 years. In fact, this week there was a very important paper in the New England Journal by Enrique Serrano from the Mayo Clinic, where they showed a large number of patients, 400-500 patients with mitral valve insufficiency who were asymptomatic and they followed them over 5 years. They found that severe insufficiency with certain parameters that they measured had a much, much higher 5-year mortality rate than patients who were not repaired with this degree of mitral insufficiency, so it’s that type of study that’s suggesting that we should most of the time be operating on these patients with asymptomatic mitral insufficiency prior to ventricular function changes, but we also now believe that we’re increasing their life expectancy by doing so.

STEPHEN B. COLVIN, M.D.

I’m just completing the approximation of the two edges of the posterior leaflet now. We’ll cut out those silk sutures in a moment and then tie these sutures and place the band.

AUBREY C. GALLOWAY, M.D.

If we can move back to the slides, then, I will go through some of the data for the non-surgeons in the audience. In particular, mitral valve repair is really a plastic surgery type
procedure on the mitral valve. It has now been done in this country for over 25 years as an alternative to replacement of the mitral valve because it keeps the patient with a more natural valve and allows better long-term outcome, so mitral repair is the procedure of choice for people who present for surgical correction of mitral insufficiency. It’s feasible in well over 95% of patients and people with posterior prolapse, like is seen in today’s patient, probably 99% of the patients can have a repair and not need the valve replaced. The decision as to whether you can repair the valve or replace the valve is made by the surgeon, based upon the echo and the transesophageal echo at the time of surgery, and then the amount of pathology that you see once you open the case, but virtually always we can tell prior to starting that we’re going to be likely able to repair a valve like this. The preferred procedure is really an anatomic repair of a valve. We like to correct the pathology that’s present in the valve leaflet tissue and then we support the valve with an annuloplasty device that really is like a new frame on the door that holds the valve back into its proper shape.

If one looks at results after mitral valve repair surgery, the first thing is that it’s very, very durable. This slide shows the top green line in non-rheumatic patients, the 10-12 year freedom from reoperation is nearly 95% and we’ve shown that those patients have much higher freedom from any complication if they have a repaired valve than if they have a replaced valve. There’s data from various centers that support that doing a repair improves survival, not only data from our own center, but this is a report that I’m showing on the screen from Moss et al, published in Circulation, where they analyzed over 2,000 patients undergoing mitral valve procedures and they did a matching study to compare exactly identical patients. 322 patients had repair. 322 patients had replacement. When they matched these patients with identical risk factors, the patients that had repair had a much, much better survival rate and a hazard ratio of death of only 0.46, compared to the patients that had valve replacement. Again, there are different methods of valve repair that we have. We’ve talked about some of the posterior leaflet methods, quadrangular resection, folding plasty, and sliding plasty. There are also methods for repairing the anterior leaflet of the mitral valve, which we have available, which now begin to give results that are equally good in these patients as we’re seeing in a typical patient with posterior leaflet disease. He’s tying down those stitches now. Let’s go back into the operating room and begin to look at how that is shaping up anatomically.

STEPHEN B. COLVIN, M.D.

Well, with this approach, when you do these operations minimally invasively, you can’t get your hands into the incision, so we tie the knots outside of the patient and we slide them down with the knot pusher, which facilitates tying these knots. All the instruments that you see us using, the needle holders and forceps, which are cylindrical, allow us to work in the small incision without having to use larger, bulkier traditional surgical instruments.

Our aim here, though, is to have arterial perfusion directly into the ascending aorta and then standard venous drainage and retrograde cardioplegia. While we do these operations, our patients are cooled moderately and then, as we’re closing and finishing the operation,
we’ll start to rewarm the patient. I’m tying the last couple of stitches now. We’ll look at the valve and then we’ll replace the band.

The video that we use is mainly through a headlight camera at NYU for the last 15 years. It was developed by my colleague, Gowan Katz, and it really allows everybody on the operative team to see these minimally invasive operations quite well, as you’re seeing them now. It’s also helpful for all heart surgery, particularly congenital heart surgery, so people can see in a small field.

AUBREY C. GALLOWAY, M.D.

I would again like to ask anyone in the audience that has questions to send them in through MDirectAccess and we will begin to answer these as the procedure goes on. We do have quite a bit of data on our minimally invasive patients. In 2002, we reported our first six years of experience, with 714 minimally invasive mitral valve operations, at the Society of Thoracic Surgeons’ meeting that year. What was quite striking was the really low operative risk that we had for our mitral valve repair cases. The minimally invasive patients had a 1.1% operative mortality, which was quite a bit lower than the national numbers for operative mortality, reported those years in the STS database. Similarly, the mortality was less in our series for minimally invasive mitral replacement compared to the STS database. We had excellent follow-up in these patients. We had studies that demonstrated equal protection of the heart, decreased pain and stress response. The patients needed less blood, with fewer wound complications and respiratory complications. The result was dramatically better cosmetically. The hospital stay was shorter and the recovery time was shorter, and we ultimately reported that the 5-year results were equally good in all the other aspects of how well they did from their valve repair surgery.

STEPHEN B. COLVIN, M.D.

This first suture that you see me placing for the annuloplasty band is at the posterior trigone. This will anchor the band to the trigone posteriorly and then the next suture will go into the anterior trigone and what we’ll be doing is elevating the posterior leaflet and annulus up to the trigone. The band has some degree of flexibility so that it can move with the heart and provide better cardiac function. You can see the trigone above the commissure as a little white dimple. When your needle goes through it, it’s tough, so you know you’re in the right tissue. We don’t place sutures with this technique and with the future band anteriorly, we allow the anterior annulus to move so that it allows for a much larger diastolic orifice.

AUBREY C. GALLOWAY, M.D.

There is an email that we have about how do we clamp the aorta. That’s a good question because we didn’t show that part of the technique. Historically we have started out using femoral perfusion and an endoaortic balloon to occlude the aorta, but for the last 4-5 years, we’ve abandoned that technique and by this direct aortic cannulation method, we
can now place a cross clamp directly on the aorta, and I’ll show you some pictures of that later. We cross clamp the aorta directly using a soft, flexible clamp. The clamp we use is made by Novartis and once the clamp is placed, you release the clamp and it simply pulls out of the way, so the surgeon can place a direct clamp on the aorta. It’s placed directly through the small 5-6 cm incision on the chest wall and the clamp is placed on the aorta and it just falls completely out of the surgeon’s way. You can’t even see it there on the film. You’re looking live. There’s the clamp there, that he’s pointing to at the top of the field.

STEPHEN B. COLVIN, M.D.

Here’s the clamp. It’s going down to the aorta where my sucker is. Okay, now, the most important thing is sizing the annuloplasty band. We go by the two trigone markers on the sizer and the size of the anterior leaflet. We’ll use a 30 mm Medtronic future band for the repair. The band has additional support at the trigones that we’ll show you, to make it additionally secure, and usually we place 8-10 sutures posteriorly around the annulus, all the sutures being placed tangentially to the annulus.

AUBREY C. GALLOWAY, M.D.

I want to talk a minute about the role of annuloplasty in valve repair. We mentioned at the beginning that we want to do a pure anatomic repair of a valve. That’s how you correct the leaflet tissue. But then we have to reframe the valve and that involves placement of an annuloplasty device. When we look at our own data, for over 20 years or more than 3,000 patients, we see that placement of an annuloplasty device is one of the strongest predictors in freedom from reoperation or for durability of the valve repair, so we begin to question what is the purpose of an annuloplasty? Well, we want to geometrically correct and remodel the annulus to match our repaired leaflets. We want to correct any annular dilation. The posterior annulus is often stretched, so we want to elevate that back to the proper plane. Those things give you better coaptation of the leaflets and, therefore, a much more long-lasting repair result. At the same time, the valve acts like a sphincter. It moves back and forth during the procedure and gets smaller during the contraction and wider when it’s opening during filling. You want to maintain that sphincter motion, so several years ago we decided to design a new annuloplasty using a new metal alloy that would remodel the annulus geometrically and yet would remain flexible throughout the cardiac cycle so we could do all the things that we needed to do with our valve repair, correct the deformity and improve leaflet coaptation, and yet remain and keep the physiologic sphincter motion of the annulus.

This is what we’re placing today. It’s called a Medtronic future band device, which we helped develop here. What we see from data with that device is that it does remodel the annulus in all cases, yet we can actually measure movement of the annulus with sphincter motion and get a 10% chance in orifice size between diastole and systole, so this allows the valve to basically function normally after the repair. Our data now is more than 450, probably approaching 500 patients for whom we have used this annuloplasty device and we have found uniformly good anterior-posterior remodeling of the valve, which was our
first goal, that the valve was physiologic, which we know from studies and measurements on our patients postoperatively, and we’ve had excellent durable results in all types of repairs, not just degenerative repair, but also patients with ischemic mitral valve insufficiency.

I see Dr. Colvin is now putting some stitches into the annulus. Maybe you might comment, Steve, on how those annulus stitches are placed. The young surgeons might want to know how do you feel the annulus, how do you know it’s the annulus?

STEPHEN B. COLVIN, M.D.

Well, if you notice, I’m constantly looking into the annulus and sometimes feeling the edge of the leaflet and bringing the leaflet away from the annulus so I can see the endpoint. The true annulus is about 1 mm beyond the flex point of the leaflet onto the annulus. You’ll see this next suture, which is really at the anterior commissure, and I hope you can see that going right into the true annulus and then we’ll have the last suture.

The next thing we’ll do is we’ll take the band. So the future band goes from posterior trigone to anterior trigone and on the back side you can see there’s a cross mark. The cross mark marks a loop in the metal alloy, so the first suture is placed into that cross mark and that gives additional security in attaching the annuloplasty band to the annulus. It’s important that all these sutures are placed into the annulus and especially that the trigones be secure. Then the holder is on the inside portion of the future band so that when we place the sutures, we can skim outside of the metal, on the outside perimeter, going through the polyester covering that goes around the metal alloy in P35.

AUBREY C. GALLOWAY, M.D.

I do have several questions. One question relates to someone who possibly needs a mitral or aortic valve replacement and they wanted to know if that was feasible minimally invasively. The answer is yet. We do also valve replacements minimally invasively, both for aortic valves and for mitral valves, and there are a variety of centers around the country and around the world that have expertise in this.

STEPHEN B. COLVIN, M.D.

Yesterday, my two patients, the first was a gentleman with a markedly enlarged heart, a ventricle of 7 cm, 25% ejection fraction, severe aortic insufficiency with fibrocalcific disease and severe mitral insufficiency with anterior leaflet prolapse. He had an anterior leaflet resection and a mitral valve repair and a mosaic aortic valve, Medtronic mosaic porcine aortic valve placed both through a small thoracotomy, just like this patient has, except that’s in the third interspace. That particular gentleman is an active deep sea fisherman and it was important that he not be on long-term anticoagulation. The next patient had prior mitral valve surgery twice. She’s in her 80s, with renal insufficiency and a BUN of 120. For her reop valve, again with a porcine valve, using the mosaic valve, it was also done minimally invasively. She had prior CABGs as well and certainly going in
from the side avoided any potential injury to any of the native coronaries or to a heart that was stuck to the back of the sternum.

AUBREY C. GALLOWAY, M.D.

Another question that we got was what would we do if we have a patient with atrial fibrillation at the time of mitral valve surgery done minimally invasively? We do a procedure called radio frequency ablation. It’s readily done through the minimally invasive technique. We now have experience with more than 200 patients where we have approximately 75% cure rate of atrial fibrillation when done along with mitral or aortic valve surgery. When we’re doing mitral valve repair surgery like this, we like to use a saline irrigated radio frequency ablation catheter called Cardioblate. That has worked extremely well. It adds really minimal time and virtually no measurable increased risk to the procedure, and you have an excellent chance that you can get these patients out of atrial fibrillation at the time of surgery and therefore, again, avoid the need for long-term anticoagulation therapy with a blood thinner such as Coumadin. This we know lowers the patient’s risk again long-term.

If we can move to the slide, I’ll again show you, this is a schematic drawing of the setup used by Dr. Colvin today, which shows a small incision on the right chest with a minimally invasive approach. That’s where he’s working through, with direct vision of the heart. The cross clamp is placed through that incision. We do not need robotics and we do not need any fiberoptics to do this. You can do it with direct vision, which is simpler. There’s a percutaneous placement of catheters for the heart-lung machine and we’ve tried to simplify this. The cross clamp, which you’ll see on the next slide, is again often placed directly through the incision and we use the cross clamp seen at the upper right, which is flexible. You place it on the aorta and it pulls out of the way, as you saw earlier.

If you look at our results, and this is through the end of 2003 and we can add about another 400 patients from 2004, we have well over 2,000 patients who had minimally invasive valve surgery. We have begun to do this operation for all of our patients with isolated aortic valves, particularly our older patients because it helps them get through the surgery easier and better. We have a large number of mitral valve repairs. Through 1983, there was 628. We’re now well over 800 mitral valve repairs. As you see at the bottom, we have begun to do this approach for many more complicated procedures, such as multiple valve operations. If we look at the evolution of our experience, as you’ll see on this graph, we went from what was called a heart port technique of femoral perfusion, which was used in the first quintile, as you see at the top, the first 20% of our experience...let me move back to the operating room for a second. You see the future band in the operating room, sliding down. That’s the annuloplasty device that the sutures have been placed through. It’s moving down onto the repaired valve to remodel the valve, as we talked about earlier. That will now be tied in place.

If we look at our results with minimally invasive, we started out with this complicated procedure. If you go to the bottom of the slide, the last quintile, the vast majority of
patients, 359 out of 363 had a direct cannulation of the aorta and direct cross clamping of the aorta, a so-called simplified minimally invasive operation, and you see the overall risk has gone progressively down with this time. The technique is now very, very reproducible and I’ll say this overall series, about 20% were actually reoperations, people that had previous surgery in the past.

Now you see again the annuloplasty device in the operating room is seated on the annulus. By this minimally invasive incision, the knots are actually tied outside of the chest wall and pushed down with a little knot pusher so the knot can be tied inside the patient’s chest, because the incision, if you remember, is quite small and the surgeon can’t get your hand down into the heart, so you have to use this long instruments to tie the knots down to the heart and that’s very readily done and really easy to reproduce. You can see it from the head camera, the knot being tied down and seated down inside the heart through the small incision.

STEPHEN B. COLVIN, M.D.

We also give repeated doses of retrograde cardioplegia during the procedure, usually every 20-30 minutes, and we’re giving additional cardioplegia as we speak. These first two sutures that I’m tying are at the trigones. The first one was at the posterior trigone. This one is at the anterior trigone. I’ll leave a snap to mark it.

AUBREY C. GALLOWAY, M.D.

Let me move to a slide I have on anterior leaflet repair. Many cardiologists and surgeons for many years thought that it was good to repair valves when it was only the posterior leaflet, but that the anterior leaflet or bileaflet involvement of insufficiency was not a good valve to repair. That’s no longer true. These are data from our own institution that we publish, showing a large number of anterior leaflet procedures, 374, over a period of approximately 10-15 years. If we look at the next slide, where we compare the patient’s anterior leaflet resection or repair, as indicated by ALR, versus those that did not have an anterior leaflet procedure and we look at the five year results for cardiac death, reoperation, or valve-related complications, we find that they are exactly the same for the patients that we did a posterior leaflet repair versus an anterior leaflet repair. This is very important because these people should not be denied surgery because the anterior leaflet is involved. In fact, we know they can get excellent durable late repair results. If we look therefore at the number of people that have anterior leaflet repair, as our experience evolved since 1980, you see through the 90s and into 2000, we now do a large number of anterior leaflet repairs every year and these patients are able to enjoy, if you will, the benefits of improved heart function and improved survival that you would expect with someone with mitral insufficiency that gets valve repair surgery. When we look at our freedom from reoperation in nonrheumatic patients in those that have the posterior leaflet repair and those that have anterior bileaflet repair, the results are almost superimposable, so again we see excellent 10-year results with people that had anterior leaflet repair, just as we had been achieving with people with posterior leaflet repair. Again, we would do an annuloplasty in all of those cases because it will hold the repair into the proper shape.
If you’ll look at Dr. Colvin tying that down, I think you’ll now see, as he cuts this, that the valve is remodeled as we wanted, into proper anatomic configuration and the proper geometric configuration, if you will, of the annulus so that the frame of the valve now matches the size of the leaflets so the two leaflets will now coapt or come together properly at the end of the procedure. We can test this in the operating room by gently distending the left ventricle of the heart with cold saline as soon as the valve repair is completed and then we further check it immediately at the end of the procedure with the echocardiogram so that we know right off that we have a good repair.

STEPHEN B. COLVIN, M.D.

When patients have ischemic heart disease, we’ve had largely patients with inferior and posterior infarction and there’s often significant dilatation of the annulus. The posterior apparatus can be tethered and pulled away and they get central insufficiency. Elevating up the posterior annulus to the trigone, you can completely correct the insufficiency in a large number of patients. We know that patients who have ischemic MR do much better with a valve repair than patients who have had a valve replacement. Our data parallels the other major centers in that finding. By using an annuloplasty band, the future band, which has some degree of flexibility and rigidity and allows the anterior annulus to move in diastole, the anterior annulus opens up and you get no gradients across those valves, so that’s a tremendous benefit of using the partial band or the CG future band.

AUBREY C. GALLOWAY, M.D.

If you go to a slide I have on this again, what should annuloplasty do in ischemic mitral insufficiency? We think the annuloplasty should primarily remodel the annulus in the anteroposterior dimension because that’s where the lack of coaptation occurs. We know the anterior annulus slightly stretches, but it has no impact, in our opinion, on coaptation because the anterior leaflet stretches along with that, but the posterior annulus drops away significantly with ischemic insufficiency, 1, 1.5 cm, maybe more, so we want to correct that by geometrically pulling that anteroposterior dimension back into the proper geometric relationship. At the same time, we want the valve to act as a sphincter again, throughout the cardiac cycle, so that we get to take advantage of the normal sphincter motion of the valve with a valve that’s smaller as the heart is contracting, therefore lowering the risk of insufficiency, so again, if we can use an alloy that gives you graded deformational characteristics. We can get both remodeling and flexibility and that’s one of the design principles of this future band device for correcting ischemic insufficiency.

STEPHEN B. COLVIN, M.D.

Okay, I’m injecting the saline that Aubrey discussed before. I’ve injected it into the left ventricle to distend the leaflets. You can see here how the band is secured to the posterior trigone, the anterior trigone, and how the posterior annulus has been appropriately elevated, taking into consideration the proper distance from the posterior annulus to the trigone. A lot of time and effort went into trying to figure that out precisely for the
different size valves, yet the key things about the future band are that on the vertical
segments, it’s rigid and it will keep the posterior annulus up to the trigones and the same
is true anteriorly up to the trigone, yet it has movement. It flexes nicely, which is very
important with the cardiac cycle. This whole anterior annulus opens up in diastole to
allow a much bigger orifice. If we had used a complete device, it would have brought all
of this closer together and would really have significantly narrowed the valve. This way,
the anterior leaflet moves more normally. The orifice is much bigger. Allowing the
anterior leaflet to move properly reduces the incidence of systolic anterior motion, which
can cause left ventricular outflow tract obstruction postop.

AUBREY C. GALLOWAY, M.D.

I’ll comment also on that, that the saddle shape of the mitral annulus really refers to the
trigones wrapping around the anterior leaflets during systole and opening back up during
diastole. This allows that saddle to come back and forth between systole and diastole
without any impediment because you don’t really want any restricting structures on the
anterior annulus. What you do want is remodeling from your posterior annulus up to your
anterior annulus, so by the design of this device, we can get both.

STEPHEN B. COLVIN, M.D.

Now we’re going to close up and take out our retractors and finish closing the atrium
and de-air the heart and start the heart up again in a moment. I’ll let Aubrey continue
talking.

AUBREY C. GALLOWAY, M.D.

We’ll finish up on our recommendations for ischemic mitral insufficiency. We strongly
believe the data, and there is a lot of data to support the fact that patients with ischemic
mitral insufficiency have better late results if you can undergo repair than replacement.
That’s particularly true in people who are less than 70 years of age and who are not in
New York heart class IV status, so we repair patients who have 2+, 3+, or 4+ mitral
insufficiency with annular dilation and moderate what we term ventricular papillary
dysfunction or moderate tethering of the leaflets, and we define that by a coaptation depth
of the valve of less than 1 cm, so if the heart’s not too stretched and the leaflets are not
too tethered, certainly less than 1 cm of tethering toward the dilated ventricle, then we
will virtually always do a repair and we use a remodeling annuloplasty device.

Now, while he’s closing the heart, one thing that he is doing and what we’ve been doing
throughout the case is flooding the pericardium with carbon dioxide, which is within the
field and minimizes the accumulation of intracardiac air. There was a question about
venting and vacuum assistance. First of all, the way we provide our venous drainage to
the long thermal venous cannula is routinely with vacuum assistance. That keeps the
heart completely empty through a small 22 French cannula placed in the thermal vein and
we can keep the right atrium of the heart completely empty throughout the procedure and
we use vacuum assistance in all cases. We did not have a vent, per se, across the valve,
obviously, when we were repairing it, but we have a vent returning blood to the pump that’s placed in the pulmonary veins during the procedure, a weighted vent that’s on the back of the retractor that Dr. Colvin had pushing down the atrium. Now, as we close the atrium, the field is being flooded with carbon dioxide. A vent will be placed across the mitral valve to vent the left ventricle and to vent the left atrium as the atriotomy incision is closed. That can then be used for getting the remaining amounts of air out of the ventricle and keep that vent on suction as blood returns reperfused to the heart until all the mitral bubbles we see are cleared from the cardiac chambers, so you’ll see, if you look on the operative screen, he’s closing the left atrium and in the upper part of that screen, the screen before was a vent that was through the atriotomy incision – it’s in your left hand corner there – through the atriotomy incision, across the mitral valve, and it’s now on suction, removing any air out of the chamber as the atriotomy incision is closed.

There’s a question we have about double valves. When you have 2 valves to do, do you use the same incision? Yes, we use the same incision. The incision we use for aortic and mitral valve surgery is a third intercostal space incision, not the fourth intercostal space incision that you saw today. The third intercostal space allows you to cannulate the aorta directly. We do all of our aortic valve isolated procedures through a third interspace incision and the third interspace incision allows you to do mitral valve surgery readily so we can then do both aortic and mitral valve surgery. Again, as I showed you earlier from some of our data, we have several hundred patients we have done this way. If we’re doing mitral and tricuspid valve combined procedures, we will often use the fourth interspace incision and, working through the wound, we’ll place a separate cannula directly into the superior vena cava so that we can open the right atrium. Again, we have well over 100 combined mitral and tricuspid valve operations done through a single right fourth intercostal space incision.

There was some question about the heart port system or port access system. We had a tremendous experience with that for 5-6 years. It did require femoral perfusion, which some surgeons were concerned about, although we had excellent results with that. It required occlusion of the aorta with a balloon catheter. Over the last 4-5 years, we’ve basically abandoned that, primarily because of cost. Although we had excellent outcomes for our patients, we found it was too complicated for most surgeons throughout the country and throughout the world to master unless they did a huge amount of mitral valve surgery every day, so we’ve converted our system to a more simplified or direct approach that you saw today, where we cannulate the aorta directly and cross clamp the aorta directly. We no longer use the heart port system.

STEPHEN B. COLVIN, M.D.

If I might add, the retractors and instruments that you see us use are ones we’re using that are S-tech instruments, which we think have sort of been the next generation of improvement in these instruments, so they allow us to do this work, I think, a little bit more precisely and with better exposure, especially the re retractors that we’re using.

AUBREY C. GALLOWAY, M.D.
There was a question, do we ever fibrillate the heart and not cross clamp? Yes, we have done some cases that way, particularly if there are coronary bypass grafts in place and all we really need to do is a mitral annuloplasty for ischemic mitral insufficiency. We will sometimes go on through this incision and simply fibrillate the heart and put in our annuloplasty device. I must say, however, we generally like to go ahead and place a cross clamp and get retrograde cardioplegia and stop the heart because I believe that improves your precision in placing the sutures and placing the annuloplasty device. In our mind, it actually simplifies it and doesn’t make it more complicated.

STEPHEN B. COLVIN, M.D.

We’re unclamping the aorta with suction of the aortic root. We’ll remove the cross clamp, which we’ve done. The heart is now perfused again.

AUBREY C. GALLOWAY, M.D.

While he’s doing this restarting of the heart, there is a question of how many people with mitral valve prolapse end up having mitral valve surgery? It’s a very small number. Probably 5% or less of the people that have mitral valve prolapse actually progress to the point that they have significant mitral valve leakage with a stretching heart and a need for some sort of surgical correction, so well over 95% of the people with mitral valve prolapse ultimately do not need surgery, but they should be followed with echoes that are done roughly each year to make sure that the leakage of the valve is not getting worse and the heart’s not getting stretched.

There was a question from Nashville, Tennessee, about a person’s relative that had minimally invasive valve surgery by Dr. Petrasik, had a valve replacement. Dr. Petrasik is an excellent surgeon that we know, actually. The question was how long before the patient recovered? The recovery time is generally about 3-4 weeks with a minimally invasive operation, which is about half the time compared to what you would expect had a sternotomy been performed and the chest opened in the older, more traditional fashion.

There was a question about our atrial retractors. The atrial retractor that we placed, the retractor that we used to elevate the septum is an S-tech retractor that we placed through a small 15 blade puncture site that lifts the septum so that we can see the valve, and we have a posterior retractor, similarly made by them, that pushes the posterior aspect of the atrium away and suctions blood out of the atrium. The combination of these two retractors give us excellent exposure of the valve, again, without the need for robotics, without the need for any fiberoptic equipment because we have a direct line of vision from the surgeon to the valve, which greatly simplifies for the surgeon doing the surgery because it’s basically using the same tools in the exact same way of repairing the valve that you would if the chest was open.

STEPHEN B. COLVIN, M.D.
Okay, you can see on the echo, if you want to have that on the screen, we’re just restarting the heart and de-airing it. The heart is beating. Sometimes if the potassium is up a little bit right afterwards because we’re giving cardioplegia right at the end, we’ll pace the rhythm a little bit. Dr. Jackson will try to point out where the vent is across the valve and then we’ll take it out. You can see the anterior leaflet moving very nicely on the echo.

AUBREY C. GALLOWAY, M.D.

Again, at this point in the procedure, the heart is starting. It has had blood returned to it and is starting to regain function. We’re not letting the heart actually pump blood to the patient yet. The vents that are inside the heart are removing all of these little microbubbles, which are most likely carbon dioxide but could be little micro air bubbles, which we now want out before we let the heart start doing all of its functioning and returning into a pumping mode, so it’s a very effective de-airing strategy. There’s also generally a vent in the aortic root that’s on suction at the same time as this and now we see return of function of the heart and he will be removing the vents which have been across the valve.

STEPHEN B. COLVIN, M.D.

Right now we’re just allowing the patient to warm a little bit. In a moment we’ll discontinue cardiopulmonary bypass. You can see there’s very good leaflet motion. If you put the cursor on where the outflow tract is, Dr. Jackson, you’ll see that there’s absolutely no SAM. It’s a big wide open area for that valve. The heart already looks much smaller to me.

At this point we have stopped the pump. The heart has recovered nicely, the valve is working nicely, and I guess that’s about the end of the show, so if you have any further questions, please email us and we’ll be glad to try to provide the answers that you’re looking for. Have a great day.

AUBREY C. GALLOWAY, M.D.

We have placed all of our data set on the website for review. People can enter the website for the next 12 months to get CME credits for this. Certainly we would also be happy to take any questions directly, if you want to email us at NYU and enter our website, we can answer any questions you might have about mitral valve repair surgery. I hope the audience, be it professional or consumer, really found this very, very interesting to come inside the operating room and see how these procedures are done. Most patients can be very, very effectively treated this way and return to completely normal cardiac function, exercise capacity, and virtually a normal life expectancy after having a valve repair. Again, we appreciate you coming with us here to NYU and showing your interest in this. Please contact us directly if you have any questions.

NARRATOR
This has been a live webcast of a minimally invasive mitral valve repair procedure from New York University Medical Center in New York City. For more information, click the buttons below.