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SMALL-INCISION MITRAL VALVE REPAIR
CENTER FOR ADVANCED SURGERY AND TECHNOLOGY
TRINITY MOTHER FRANCES HEALTH SYSTEM
TYLER, TEXAS

00:00:08
ANNOUNCER: Welcome to the Center for Advanced Surgery and Technology at Trinity Mother Frances Health System in Tyler, Texas. Over the next hour you will see a small-incision mitral valve repair and how patients benefit from the technique used at Trinity Mother Frances Health System. When the mitral valve doesn't function properly, blood can't move through the heart or to the rest of the body as efficiently. Patients can be fatigued and short of breath. Rather than an open procedure in which the ribs are cracked, doctors use a small incision to get to the heart. The valve can be repaired or replaced through the opening and patients experience a quicker recovery than with a traditional open approach. OR-Live makes it easy for you to learn more. Just click on the "Request Information" button on your webcast screen and open the door to informed medical care. Now let's go to the moderator of tonight's webcast.
00:01:00
BILL TURNER, MD: Good evening, everyone, and welcome to Mother Frances Hospital in Tyler, Texas. I'm Dr. Bill Turner, the director of the Center of Advanced Surgery and Technology and the moderator of tonight's program. Tonight what you're going to see is a revolutionary breakthrough in cardiac surgery whereby a patient will undergo a heart valve replacement through a very small incision in the right side of his chest. Now, traditionally this operation's been done through what we call a median sternotomy incision. With this incision, the breastbone is split from top to bottom with a saw and retracted very widely to allow optimum exposure for the surgeon. Well, recently techniques have been developed whereby this operation can be performed through a two-inch incision on the right side of the chest. This enable a much quicker recovery, fewer post-operative complications, and obviously less pain. In addition, you're going to get to hear an interview from a patient who has undergone this procedure and give a unique perspective from a patient's point of view. Finally, you're going to have the opportunity to ask us questions by hitting the Direct Access button on your screen. And right now it gives me great pleasure to introduce the surgeon who's going to perform this procedure tonight, my partner Dr. Neeland Doolabh.
00:02:14
NEELAN DOOLABH, MD: Thank you, Bill. We're pleased to have you all here with us this evening to allow us to share with you our techniques for minimally invasive mitral valve surgery here at Mother Frances Hospital. This procedure was developed by Dr. Michael Petracek and differs significantly from the traditional operation. As you mentioned, the traditional operation involves us dividing the entire breastbone, stopping the heart, and then repairing or replacing the mitral valve. The biggest limitation with this procedure is the healing of the breastbone after surgery. Unlike other bones in which we can place a cast, allow a period of immobilization, that's just not practical with the breastbone. Having said that, we rely on our patients for a period of six weeks to two months after surgery not to use their arms in order to allow their breastbone to fuse and stabilize. As you can imagine, this provides a significant limitation on their return to full activity and return to work.
00:03:07

BILL TURNER, MD: Okay, so you're not going to split the breastbone.
00:03:09
NEELAND DOOLABH, MD: Correct.
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BILL TURNER, MD: And you're going to make a very small incision in the chest.
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NEELAND DOOLABH, MD: Correct.
00:03:13
BILL TURNER, MD: So when are these people going to be able to get back to hunting, fishing, and what all of us East Texans like to do?
00:03:19
NEELAND DOOLABH, MD: We've been extremely pleased with this operation. Most of our patients stay three days in the hospital and are back to full activity within two weeks. The way we do this operation is done through the right chest. We make an incision that's approximately an inch and three quarters in length.
00:03:33
BILL TURNER, MD: That's extremely amazing.
00:03:34
NEELAND DOOLABH, MD: We don't stop the heart. We get full access to the mitral valve, and we can do any operation that we can do through the chest, meaning we can do complex repairs or replacements.
00:03:44
BILL TURNER, MD: That's truly amazing. I see you've got a couple of our colleagues with us today. Would you like to introduce those to the audience?
00:03:51
NEELAND DOOLABH, MD: Sure. To my right is Dr. Carl Sulser, who's one of our senior cardiac anesthesiologists here, hence the gray hair. And he virtually does all these cases with me. And as well we have our chief perfusionist, Warren Goodwin, who's been doing this I think for 26 years.
00:04:08
BILL TURNER, MD: That's truly amazing. Now, you're going to give us a presentation of an actual patient that has done this procedure, and I noticed right off that this is a 79-year-old lady. To me that's amazing in and of itself, but it raises the question in my mind, are there certain patients who can have this operation just because of their age?
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NEELAND DOOLABH, MD: We have no limitations based on age. In fact, the older the better, because those are the patients that truly benefit the most by the little incision, the less postoperative discomfort, and they're back to their activities sooner.
00:04:43
BILL TURNER, MD: That's amazing.
00:04:44
NEELAND DOOLABH, MD: I'd like to start with our case presentation for today. This is a young lady -- well, 79-year-old lady that we operated on approximately six weeks ago. She has a past history of rheumatic fever, and she presented to us with severe mitral valve stenosis, which is narrowing of her mitral valve. Her mitral valve opened approximately 1 centimeter-squared, whereas the normal mitral valve should open in the range of 4 to 6 centimeters-squared. Her valve as well was leaking significantly. Her main complaint was fatigue, worsening shortness of breath, just really couldn't get around as well as she had in the past, as well as on her evaluation she was noted to have worsening pressures within the heart, particularly her pulmonary pressures and her right-sided heart pressures. Based on this, the patient was referred for surgery. As part of her evaluation as well, she underwent first an EKG, which demonstrated her heart was in a normal rhythm. She underwent a chest x-ray which shows signs already of congestive heart failure. Her heart was bigger than it

should be, she had a small amount of fluid around her lungs, and so we become concerned. In addition, she underwent a pre-operative cardiac catheterization, and this is done routinely on patients to exclude any concomitant coronary vascular disease, meaning blockages on the blood vessels of her heart, and she had no significant blockages on her vessels.
00:06:00
BILL TURNER, MD: So when you're doing this operation and you do a cardiac cath and someone has what we call multi-vessel disease, are these patients candidates for this procedure?
00:06:11
NEELAND DOOLABH, MD: That's a good question. In order to get access to all the blood vessels within the heart, those patients we typically do through the big incision, meaning we do their bypass surgery at the same time as their valve operation. Some patients have focal disease, meaning one or two coronary arteries that have tiny focal blockages in them. Those patients we often send to our cardiology colleagues, who perform a stent, thereafter address the blockages on their heart and allow us to come back and do their valve surgery at a later date.
00:06:39
BILL TURNER, MD: And this is what I understand to be a hybrid procedure.
00:06:41
NEELAND DOOLABH, MD: Correct, correct. This allows the patient the benefits, again, of avoiding a sternotomy, and they can still get their heart revascularized as well as their valve addressed.
00:06:50
BILL TURNER, MD: Great.
00:06:53
NEELAND DOOLABH, MD: To allude to that question, there are some patients that are ideal candidates for this operation and others that aren't. Essentially, anyone with any significant mitral valve pathology can be done through this incision, excluding those patients, as we mentioned, with severe coronary artery disease. In order to accomplish this operation to place these patients on bypass, we have to cannulate them, or put them on the heart-lung machine in a different fashion, and we do this through the femoral vessels in the groin. So any patient that has blockages in those arteries are not an ideal candidate for this. As well, patients that have a leaky aortic valve. The aortic valve is another valve within the heart. If that leaks significantly, then this hinders our visualization during this type of operation.
00:07:36
BILL TURNER, MD: Now, in East Texas, we eat a lot of catfish, burritos, and barbeque, and we've got some rather large people that we operate on. Are these patients candidates for these procedures, or do they have to be kind of skinny guys like Warren and Carl here?
00:07:51
NEELAND DOOLABH, MD: Sure. No, they absolutely do qualify. And as you know, I get more than my fair share of the larger patients. And you know, I think again that these are the people that benefit the most in that if you need your hands to get around -- if you're a larger patient, you may need your hands to get out of bed, to help yourself get up the stairs, things of that nature. After the traditional operation, if you utilize your hands, you can actually break open your breastbone. So in those patients, I do everything we can to do this operation through the chest.
00:08:19
BILL TURNER, MD: So what you're saying and what I'm gathering is that the sicker the patient, the greater the benefit it is to them to offer this type of minimally invasive procedure.
00:08:28
NEELAND DOOLABH, MD: Absolutely.

00:08:29
BILL TURNER, MD: Very good. I know that anesthesiologists play a very important role in our operation, and I know that considerations in this procedure are very great because it's a lot different than a normal cardiac procedure. Carl, would you explain to us some of those differences and why those differences exist and why they're important.
00:08:51
CARL SULSER, MD: Sure, Bill. There are some differences from traditional mitral valve replacement. We routinely in these patients put a double luminal tracheal tube so that we can drop the right lung to give the surgeon adequate exposure as he's entering through the right chest, so that's one slight difference but something we routinely do in anesthesia. One other difference is that we don't, in these patients, once they go on bypass, we don't routinely cross-clamp the aorta and completely stop the heart. What we do one we're on bypass, we cool the patient down below 28 degrees centigrade and we fibrillate the heart. And the heart is continuously fibrillating on bypass but is continuing to be perfused throughout the operation.
00:09:29
BILL TURNER, MD: So you don't arrest the heart like we do traditionally.
00:09:32
CARL SULSER, MD: No, we don't.
00:09:33
BILL TURNER, MD: You don't put a clamp on. I want to get.. Dr. Doolabh to comment on that a little bit later, but go ahead, that's fascinating.
00:09:37
CARL SULSER, MD: So to be able to induce ventricular fibrillation once we're on bypass, instead of passing the traditional CVP or Swan-Ganz catheter through the internal jugular vein, we pass a patient Swan-Ganz catheter at the beginning of surgery. And once we're on bypass, we are able to initiate fibrillation on bypass through the patient's Swan. And one of the other things that we do routinely which we also do in other open heart surgeries, but we routinely monitor the cerebral oximeter so that we're sure that the patients are getting adequate oxygenation of their brain and other vital organs. And to be able to do this, it's imperative that the anesthesiologist have skills in TEE techniques to be able to pass the cannulas and to evaluate mitral valve and also ventricular function.
00:10:25
BILL TURNER, MD: Superb. Thanks, Carl. Now, to do this operation we have to use the heart-lung machine, and traditionally when we make the big sternotomy incision, we're able to directly access the heart through the various chambers and the various blood vessels. Now, when Dr. Doolabh does this through a two-inch incision, I understand we have to have what is known as peripheral cannulation. In other words, we can't cannulate directly into the heart; we have to put the patient on bypass through other vessels. Can you kind of talk to us, Warren, and what that entails.
00:10:52
WARREN GOODWIN, CCP: Certainly. Well, the role of the cardiovascular perfusionist is to operate the life support system that circulates the blood for the patient as an assistant if the heart is arrested or in fibrillation, as we do for this procedure. A number of differences we have in a normal bypass procedure to the minimal opening procedure. One of those is, as you mentioned, the cannulation. Normal cannulation through the chest would be a large tube, and we would just get a gravity drain of blood from the patient into the system, into the circulating system, and the blood would be oxygenated and pumped back to the patient. For utilization of a smaller cannula, we need assistance in getting the blood out of the patients, therefore we use a system that will help to pull the blood out. And there are two different ways to do that: one is a kinetic energy negative pressure or a vacuum-assisted negative pressure. Both of those systems work very well for the patient. The other thing that we do, as has been mentioned, is decrease the patient's total body temperature. And

this is for support of the vital organs of the body. And for every one-degree drop in centigrade that we make, we decrease the oxygen demands on the vital organs by seven percent. So as was suggested here, a decrease of body temperatures from approximately 37 degrees centigrade to 27 degrees centigrade is quite a reduction in the oxygen demand for the vital organs to help those. One of the other things that we do is we'll infuse in the surgical site CO2, which essentially pushes out any other inert gases in the area so no air entrainment happens within the bloodstream and the patient doesn't have any complications from air.
00:12:54
BILL TURNER, MD: I guess what's really impressive to me, Warren, is that there's so much more to this operation than just Dr. Doolabh working through a two-inch incision. Each member of our team plays a vital role to join in, in the success of this procedure, and I appreciate your efforts in making this clear both to myself and the audience. Are we ready to go to the video?
00:13:20
NEELAND DOOLABH, MD: I think we are. We have a video of, again this patient that we did several weeks ago. If we could play the video, please.
00:13:31
BILL TURNER, MD: While we're waiting for that, these questions are really coming in, and I was wondering if I might ask you a quick question before we get started here.
00:13:37
NEELAND DOOLABH, MD: Sure, sure.
00:13:39
BILL TURNER, MD: This is from Chloe Rogers in Nashville, Tennessee. She says she's a country-western singer. But she wants to know if we're able to do these type of operations for people with aortic valve disease.
00:13:49
NEELAND DOOLABH, MD: Oh, absolutely. We have applications for that. The operation is a little different in that the incision is more anterior on the chest. It's done through the third interspace on the chest. For this operation, since the aortic valve is right in the beginning of the heart as it ejects to the body, we do have to stop the heart. So we do place the patient on bypass, stop the heart, and as well excise or repair the aortic valve as we need to.
00:14:17
BILL TURNER, MD: Let me go with one more question, because I know we're all anxious to look at the video. Here at Mother Frances, we have the robotic technology and we have three robots. And as a matter of fact, we've done more coronary bypass procedures than any program in the state of Texas. And one of our viewers, Billy Franklin, wants to know, "Are you using the robot for the heart valve procedures?"
00:14:43
NEELAND DOOLABH, MD: Well, as you mentioned, Mother Frances is very active in robotic cardiac surgery, and we've looked at all options in how to address these patients with valvular heart disease and we've elected this particular procedure for a few reasons, and that reason is that we can accomplish this entire operation through one incision. We no longer require an incision to place the valve in addition to three or four robotic arms into the patient. As well, with this technology we're able to repair any valve, replace any valve with any sort of annuloplasty band or annuloplasty ring that's currently available. As well, we get a little bit higher degree of confidence for valve surgery. The robot has excellent applications for coronary bypass surgery, but with valve surgery we really like to feel that the valve is snug. And the only way we can truly do that is by using our hands. So we've elected to do this operation both for the aortic valve and the mitral valve. In fact, we do all our patients that don't have any concomitant coronary vascular disease all through the little incision.
00:15:42

BILL TURNER, MD: And what's really impressive to me is the only time that you struggled during this operation is to get the valve through the incision. You have to bend it because the valve is really a little bit bigger than the incision, so you kind of have to position it and almost shoehorn it in. So we're going to see this. Let's get started.
00:16:02
NEELAND DOOLABH, MD: Okay. Can we play the video, please? This is the patient's intraoperative TEE, which we'll pause for just a second. A TEE is a transesophageal echocardiogram, and it demonstrates the valve. What you'll see here in a minute, this is the left ventricle and this is the left atrium. Dividing those two chambers is the mitral valve. This is the anterior leaflet of the mitral valve and the posterior leaflet. The mitral valve is essentially made up of two leaflets. Once we play the video, you'll see that this mitral valve leaflet, the anterior leaflet, is very calcified. It's fixed in place. It's relatively immobile. And you can see that the posterior leaflet moves as well. Based on this information, we make our operative plan. Looking at this echo, we immediately knew that this is not a repairable heart valve and that we would replace this heart valve. Based on the patient's age, we elected to replace this heart valve with the porcine valve. We'll go ahead and play the video again, please. And you can see that posterior leaflet moves nicely, so that's going to be preserved with this operation, keeping all the subvalvular apparatus intact, and you can see this anterior leaflet just does not move at all.
00:17:09
BILL TURNER, MD: And this is the actual incision.
00:17:10
NEELAND DOOLABH, MD: This is our incision. This is a female patient. And you can see our incision is fairly small. The nice thing about the incision is it's done in the inframammary fold, right underneath the breast line, so it's very, very cosmetic. We always begin with this, meaning we start this incision, get access to the chest. We make sure that there are no surprises, that we have good visualization of the heart. And once this is accomplished, then we proceed with cannulation. I'd like to pause the video here for a brief second. At this point, the patient is given heparin, or a blood thinner, and then we proceed with cannulation. Cannulation involves us placing the patient on the heart-lung machine. I think we have a slide of what a normal operation looks like. And in order to do a normal operation, using this model of the heart, we need a separate cannula that goes here into the inferior vena cava, one that goes here into the superior vena cava, one that goes here in the aorta, as well as two other cannulas that provide cardioplegia, or the medicine to arrest the heart. As you can imagine, we don't have full access to the heart in order to do this, so the way we cannulate these patients is with a different type of cannula. This is the Medtronic arterial cannula that we place in the femoral artery. It's fairly small in nature, and as Warren mentioned, we use certain techniques such as vacuum-assisted drainage and other techniques to make this work. Our venous cannula, which is slightly longer, as you can see, is designed to go through the groin and not only go into the inferior vena cava but as well as the superior vena cava. It has holes in both those locations: there are holes in this region here as well as a set of holes here. And this allows us to accomplish what you see through the traditional cannulation strategies, all done through this. What we'll do now is play the video and show you a little bit of this.
00:19:04
BILL TURNER, MD: Neeland, let me ask you a question before we start that. In a traditional operation, there are a lot of holes made in various chambers of the heart. Now, when you do this operation, correct me if I'm wrong, there's one incision in the heart, is that correct?
00:19:20
NEELAND DOOLABH, MD: Correct. There's one incision that measures usually about an inch in length, which helps us tremendously in that we're not traumatizing the heart, making all these holes into the heart. And as well, postoperatively, we have one incision to worry about

from a bleeding standpoint, so we can really inspect that very well. And these patients tend to have markedly reduced blood requirements as well as blood loss after the operation.
00:19:42
BILL TURNER, MD: So in a traditional operation, I guess you're going to make a hole at the bottom of the heart, a hole at the top, you're going to make a hole in the aorta, and then you're going to put that cross-clamp across the aorta. And I guess your problem there is if you put that across the aorta, you can break off what we call plaque, or parts of atherosclerosis, which can go to the brain. So it would seem to me that if you can avoid cross-clamping the aorta, you would diminish the patient's risk for stroke. Is that correct?
00:20:09
NEELAND DOOLABH, MD: Oh, absolutely. The benefits of this operation are numerous, and that is a big one, and I'm glad you pointed that out. These patients virtually, if we do a good job of de-airing the patients after the operation, have zero stroke risk, which is different from the traditional mitral valve operation.
00:20:24
BILL TURNER, MD: And when you put that clamp across the aorta, you do that to create a cold and quite heart. But the downside is you deprive the heart of its blood supply, specifically the coronary arteries.
00:20:35
NEELAND DOOLABH, MD: Right.
00:20:36
BILL TURNER, MD: What happens -- when you do your operation, what happens to that blood supply? How is that different than when we have to cross-clamp the aorta?
00:20:44
NEELAND DOOLABH, MD: Oftentimes these patients with severe mitral disease have a very weak right heart, and that right heart becomes weak because it's not used to working against the pressures that are now generated within the heart. And that's the downside of a traditional operation is that we stop the heart. And every 15 minutes or so during a traditional operation, we have to stop what we're doing and provide cardioplegia or a medicine to try to protect the heart. The right heart is thinner because it's not really designed as a pumping chamber. And that thin heart, particularly if it's weak already, can become severely compromised with the operation. And this technique with the heart fibrillating, cold, decompressed, we're providing normal blood flow to the entire heart through the entire operation. So these patients generally do much better coming off the heart-lung machine, require much fewer medicines to support them in the ICU afterwards.
00:21:35
BILL TURNER, MD: I see.
00:21:36
NEELAND DOOLABH, MD: Thank you. Can we play the video, please? What we're doing here is we're now at the patient's left groin, exposing the femoral vessels. The patient has been given heparin at this point.
00:21:51
BILL TURNER, MD: Now, heparin is a blood thinner that allows the blood to be thinned so it doesn't clot on these drains. I've got a question from Darryl. He's a hunting guide out in West Texas. He wants to know, can this operation be done without the use of blood?
00:22:08
NEELAND DOOLABH, MD: It can. Our blood product results are much thinner. It all depends on the patient, meaning where their blood volume is starting before the procedure. But most of our patients require no transfusion.
00:22:18
BILL TURNER, MD: Okay. I know that our cardiologists lose only about 10 to 20 cc's after each cath, so most of our patients come in with a good hemoglobin.
00:22:24

NEELAND DOOLABH, MD: Absolutely. You do a great job.
00:22:28
BILL TURNER, MD: That's great.
00:22:30
NEELAND DOOLABH, MD: Video, please. This is the cannulation again. What we are doing is ensuring that there's no air within the system. This is the arterial cannula, which is placed in the femoral artery. Every little bubble matters in that we remove this cap to make sure that there's no air hidden under any of the joints of the catheter. This is the TEE view, and this is critical. This is where we place that venous cannula, the long tube, into the superior vena cava. What you'll see here is the tube sliding into the superior vena cava. The inferior vena cava is here, and this is the right atrium.
00:23:05
BILL TURNER, MD: Now, who's working the transesophageal echo at this time?
00:23:09
NEELAND DOOLABH, MD: Dr. Sulser would do this at this point. So he coordinates with me and he ensures that all my guide wires are placed in the correct place, that the cannula's in the correct place before we even go on bypass. What you can see here is now we have the venous -- excuse me, the arterial line. The venous line, the patient will now go on bypass. You'll see that this will turn red, meaning we'll start delivering oxygenated blood to the patient and remove the darker, non-oxygenated blood away from the patient. We're simply securing the cannulas in place at this time.
00:23:40
BILL TURNER, MD: Warren, is there a particular flow that you want to achieve with these peripheral cannulas, and is that harder to do when a patient's put on bypass through the groin as opposed to the chest?
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WARREN GOODWIN, CCP: Well, patients, due to their size, have a calculated blood flow, which is usually given to us by the cardiologist who do a workup with them. Also, the anesthesiologist has a Swan-Ganz catheter in these patients, so he monitors the cardiac output for the patients. We try to mimic that cardiac output that the patients have during their normal blood flow. In these particular cases with the smaller cannulas that we use and also the reduction in body temperature, we can actually flow lower flow and do just an adequate a job as the normal blood flow that patients have as they're walking around on their own.
00:24:27
BILL TURNER, MD: Good.
00:24:31
NEELAND DOOLABH, MD: At this point we are now on bypass. The process has begun to start cooling the patient's heart. The heart is now decompressed. We're working our way down to a safe temperature in order to allow us to defibrillate. Heart-lung machine there.
00:24:47
BILL TURNER, MD: Now, I've noticed in this operation you've lost very little in the way of blood. We got a question from Arlene who wants to know how many cc's of blood do you lose in this operation.
00:25:00
NEELAND DOOLABH, MD: Sure. Well, the heart-lung machine is a circuit, so most of the blood that we do lose we return to the patient via the various suckers that we use. Typically on the order of about 150 cc's, which is about half a can of Coke. Not very much. Play the video, please. At this point we are now opening the pericardium. The pericardium is the protective sac within which the heart lives. The heart is now in the background here. It's decompressed. And being decompressed, we can safely open the pericardium. We open it from the level of the superior vena cava down to the diaphragm.
00:25:35

BILL TURNER, MD: Okay, now where is the patient's head and where is his feet?
00:25:40
NEELAND DOOLABH, MD: Sure. Could we pause the video, please? Patient's head is here towards the left. Their feet are to the right. What you see here is we essentially have a single incision. This port that we placed in the patient is not our normal operation. That was simply placed in order to allow us to place a camera through that port to videotape this procedure. We're missing a small portion of our video, so I'd like to stop here and tell you what happens next. Once the patient is adequately cooled and their heart is decompressed, Dr. Sulser will initiate fibrillation. Once fibrillation is done, what we do at this point is we open the heart. Our incision to the heart is right here, which is on the bottom side of the heart. Make an incision that's about an inch long. We go through this incision here and we get access to the mitral valve, which is this widest structure here. The way we get access to that is once the heart is open, decompressed, and no longer ejecting, we use this retractor that was devised by Dr. Petracek again. And what this retractor does, which is essentially just a homemade reusable retractor, that is placed through our incision here in the chest, goes into the patient, elevates that little incision that we have in the heart, and allows us to see through that little hole to the mitral valve.
00:27:05
BILL TURNER, MD: Do you have an assistant in this operation? This looks kind of like a one-man show?
00:27:09
NEELAND DOOLABH, MD: It is. That's actually a significant point about this operation in that it is a one-man show. So in order to entertain doing an operation of this type, you have to be relatively organized. You can't rely on your assistant to move things out of the way, to help you to see things. The operation has to go in steps and has to have a plan. Our assistant is usually just one of our nurses, and their jobs is difficult: holding that retractor. We use a mobile retractor in that we can move it around in order to get access to the different portions of the mitral valve. If we could, we have a 3D TEE of a normal mitral valve to kind of show you what a valve should look like, and then we'll show you our valve.
00:27:52
BILL TURNER, MD: Okay, can we see that?
00:27:59
NEELAND DOOLABH, MD: Well, this is the view that we see as surgeons of the mitral valve. Hopefully you're seeing that at home. And what you see here is two leaflets: an anterior leaflet and a posterior leaflet. As you can see, they're very mobile, they move in unison, they're very flexible. In our patient what you'll see is this anterior leaflet, as we saw in the preoperative TEE, is very fixed, fibrotic, does not move, very calcified, and the posterior leaflet moves. So our plan for this patient will be once we see the mitral valve is we'll start detaching this anterior leaflet from what we call the annulus, which is the fibrous ring that it lives in. Can we play the video, please? So at this point the pericardium is opened. As we mentioned, the patient is not fibrillating. We place our retractor in place and our assistant gets ready with her protective cushion -- she's going to be there for a while -- and gets us access. Immediately we put drainage tubes into the heart. This is just a flexible suction and a firm suction. And again, all this blood is being returned to the heart-lung machine.
00:29:09
BILL TURNER, MD: Goes back to the heart-lung machine and then Warren can give it back to the patient, introducing the need for transfusions.
00:29:15
NEELAND DOOLABH, MD: Now you see the mitral valve. This is the view that I see. Again, here is the anterior leaflet. And this is clearly abnormal, very fibrotic, very calcified. And what we'll start doing is detaching it at about 12 o'clock and we'll work our way over to 3 o'clock and then back to 9 o'clock to remove this valve.
00:29:33

BILL TURNER, MD: Okay. Now, we're seeing a lot of blood here. What is that blood from?
00:29:36
NEELAND DOOLABH, MD: This valve was so immobile that there's some blood that has built up in the chamber behind the valve. The heart's not ejecting or squeezing at this point, so it's just blood that had collected there. Now you no longer see that blood coming in. We actually have excellent visualization of the mitral valve.
00:29:51
BILL TURNER, MD: That valve looks like a rock.
00:29:52
NEELAND DOOLABH, MD: It is a rock. As you can see, while we're trying to tease it out of the way, it moves the entire heart. Visualization is somewhat difficult for you at home in that we're relying on a headlight camera in order to see this, and I typically have a better view. This is the valve as it's removed. It's very rocklike, just as advertised on the Echo, and has some of the chordal structures attached. Clearly a rheumatic heart valve.
00:30:23
BILL TURNER, MD: Neeland, I know in your practice that you're able to repair 85% to 90% of your valves that are due to insufficiency or degenerative disease. This particular type of valve, there's no way this valve could be repaired, so you have to replace that.
00:30:38
NEELAND DOOLABH, MD: Absolutely.
00:30:39
BILL TURNER, MD: Okay.
00:30:40
NEELAND DOOLABH, MD: At this point what we're doing is we're inspecting the remainder of the heart valve, deciding which areas we're going to preserve. We essentially preserved the entire posterior leaflet, some of the chordal structure to the anterior papillary muscles. We want to excise any tissue that may hinder the function of our valve, which is what we're doing at this point. This is the sizer that helps us determine which size heart valve to place. This is a Medtronic Mosaic sizer. This is a size 25. The sizes start at 25 and go to 33. This is the smallest sizer they make, and as you can see, that essentially just barely fit through our incision. All the other sizes, as mentioned, we have to tilt, as you said, and try to squeeze in. What we'll do is we'll take some time to make sure that this sizer adequately replicates the patient's annulus, and that's what we're doing at this point. Once we've decided on the size, we then ask our nursing staff to pull one off the shelf, essentially -- this is a pig valve -- and start cleaning it. Could we hold the video for just a moment, please? At this point what we'll start doing is preparing the annulus to accept our heart valve. What we'll do is we'll place usually between 10 and 15 double-arm sutures circumferentially around the annulus, or the ring that the valve used to live in. In order to do this, we require specialized instruments. These are needle holders and needle drivers that are made by CardioVations. And what this allows us to do is work with fingertip control. We know these are very different from our normal surgical instruments, which are designed to fit in the palm of our hands. This is all done with our fingertips. What this allows is for us to look through a small incision, work with our fingertips, get additional length, and not have our hands blocking what we're trying to see. So these sorts of instruments are critical to the operation that we do. And another thing that's critical to this operation, again, as we mentioned, this is all about organizing the operation and making it as easy as possible. The valve that you will see today is this one. This is the Medtronic Mosaic cinch valve. This is essentially a casing of a valve without having the true valve leaflets in place. And the benefit of this valve, or the reason I like using this valve for this operation, is that as the name mentions, we can cinch it down. So we simply ratchet this holder in place, and what that does is it allows the posts of this valve to fold out of the way. Once the posts are folded out of the way, as we place the valve back into the annulus, we don't have to worry about the 20 to 30 sutures getting snagged on the post and causing a problem. So I think you'll see a little about that.

00:33:34
BILL TURNER, MD: This is a tissue valve, a porcine valve, which is the pig valve, so to speak.
00:33:39
NEELAND DOOLABH, MD: Correct.
00:33:40
BILL TURNER, MD: Now, the other type of valve is a mechanical valve?
00:33:41
NEELAND DOOLABH, MD: Sure.
00:33:42
BILL TURNER, MD: It's one that's indestructible and lasts forever. Why would you not use that valve in this particular patient?
00:33:49
NEELAND DOOLABH, MD: Mechanical valves, as you mentioned, provide excellent durability, but the downside is that patients require long-term blood thinners in order to have that valve in place. So we generally reserve that valve for younger patients in that sometimes these elderly patients don't tolerate blood thinners very well. They can have bleeding ulcers, GI problems, or they can fall. So blood thinners are usually not recommended.
00:34:14
BILL TURNER, MD: This is an email. It's not really a question, but to me this is one of the most rewarding parts of being a physician, and that's the gratification that we get when patients do well. This is from one of your patients. "Dr. Doolabh performed this surgery on me and my brother about a year ago. I don't have any particular question at this time but wanted to express my appreciation to Dr. Doolabh and Dr. Sulser" -- and I'm going to also thank Mr. Warren Goodwin because I'm sure he was there at the time -- "for their expertise in performing this procedure on us. We're both doing great. Regards, Steve Wright."
00:34:47
NEELAND DOOLABH, MD: Well, I appreciate that. I think if we could play the video, please. So at this point we're placing our sutures around the annulus. We usually start at about 8 o'clock, if this were a clock, and work our way counterclockwise circumferentially around the valve. As you can see, each suture has two parts. In the middle of the suture is what we call a pledget, which is just a small piece of felt that helps buttress the suture in place. The valve is now being prepared. It's essentially being rinsed off, rinsing off any of the preservatives that came with the valve. It's usually a process of rinsing the valve for a couple of minutes in three separate basins. And you can see that the sense mechanisms rather has not been deployed at this point.
00:35:40
BILL TURNER, MD: Now, this is a tissue valve, it's not mechanical, so tissue theoretically can wear out. Will this patient's valve wear out, and will she need surgery again?
00:35:51
NEELAND DOOLABH, MD: This is the third-generation valve, and what the data suggests is that 15 years, approximately 80% of these valves are still functioning. So when this particular patient is 94 years old, she has an 80% chance of this valve still being okay.
00:36:05
BILL TURNER, MD: So you might be able to replace it, but Dr. Sulser and Mr. Goodwin and myself won't be around to do so.
00:36:12
NEELAND DOOLABH, MD: Yeah, I won't comment. You can keep going, please. So you can see the sutures are placed. We've preserved the entire posterior leaflet, which is that bottom part of the mitral valve which is kept in place, and we just simply work our way around the clock. Now all the sutures have been placed. We're verifying that everything is in position. And now what we'll do is we'll bring the valve into place and we will place those sutures that were on the annulus around the heart valve and corresponding to the spacing that we've used on the inside. So this portion of the operation is done outside of the

patient's chest, and then the valve is simply just lowered in place. As you mentioned, if we use a bigger valve, we just turn the valve sideways as we slide that in, reorient it, and then place it within the chest.
00:37:02
BILL TURNER, MD: What's the largest valve that you've ever put in?
00:37:05
NEELAND DOOLABH, MD: For the mitral position, the largest one they make, which is a 33.
00:37:08
BILL TURNER, MD: And you did that through a small incision?
00:37:09
NEELAND DOOLABH, MD: Yes.
00:37:10
BILL TURNER, MD: How did you get that valve in there?
00:37:11
NEELAND DOOLABH, MD: Well, again, this is a little bit pliable in that we can bend it slightly without damaging the leaflets, just tilted it sideways and made it work. We're just working our way around. You can see that the stent posts have been folded in place, and what we're doing at this point is just moistening the sutures to allow this valve to slide into place.
00:37:35
BILL TURNER, MD: Here's a quick question from Anders Salillo. He appears to be a physician, wants to know about cardioplegia, and I think you answered that earlier.
00:37:45
NEELAND DOOLABH, MD: This operation, the heart is beating and receiving normal blood flow throughout the entire operation, so we don't have to stop the heart to give cardioplegia every 15 minutes or so.
00:37:55
BILL TURNER, MD: Gotcha.
00:37:57
NEELAND DOOLABH, MD: At this point I think we'll lower the valve into place.
00:38:03
BILL TURNER, MD: And so now you're going to tie all of these sutures and the valve will be in place. Now, this heart is open to air in the room. What's going to prevent air from getting into the heart and going up into the vessels in the head and causing all sorts of neurological complications and strokes.
00:38:22
NEELAND DOOLABH, MD: Right. This heart is currently not ejecting, meaning it's decompressed and it's not squeezing. So we don't have any forward flow of blood through the patient. As well, the patient is receiving blood via his femoral artery, which is going up his aorta and then will hit against a closed aortic valve. So that will keep the aortic valve closed. We never drop our pressures lower than 30 milliliters mercury because that could allow that valve theoretically to open, so that valve is closed at this point. And we utilize CO2 -- this little tubing right here actually is a tube that is carrying CO2 at about 3 liters per minute into the patient's chest. CO2 is heavier than air in that it displaces any air that builds up within the chest. CO2 is much more favorable in the bloodstream than air is in that it can dissolve rapidly. You mentioned tying these sutures, which is an important point. I'd like to show you a little bit about how that's done. We utilize this instrument here, which is the [Chitwit] knot tier. As you can imagine, to tie those knots, which are about 8 or 10 inches away from our fingers, we can't get our hands to it. So what this requires is a little bit of a coordinated effort in that the knot tier's in the surgeon's left hand. One of the arms of the suture is in the right hand, we tie the suture, lower the knot in place while our assistant, who's holding the retractor with their other hand, in a coordinated fashion holds the appropriate amount of tension to allow us to tie this in place. And again, this is the advantage of this operation versus other minimally invasive approaches to this operation in

that we can truly feel what we're doing with this instrument. We can insure that the valve is seated in place nicely, that it's a nice, snug fit, that we're not underfastening it in place. I think we can play the video, please. At this point, this will illustrate a little bit of the knot-tying techniques.
00:40:28
BILL TURNER, MD: So when you're tying these knots, you're doing this outside of the chest and you're doing this using this nifty little device to, I guess --
00:40:37
NEELAND DOOLABH, MD: Slide the knot in place.
00:40:39
BILL TURNER, MD: Push the knots. Okay, what is this right here?
00:40:41
NEELAND DOOLABH, MD: This is a monitor showing that the patient is fibrillating. Again, the quivering of the heart. It's not the normal, nice geometric pattern that you see with a normal heart rhythm, just shows that the heart is decompressed, it's fibrillating, there's no ejection. It's essentially very happy.
00:40:59
BILL TURNER, MD: Okay. We had a question earlier. We used a porcine valve. Can you use a bovine, a cow valve, if you will, in this position?
00:41:13
NEELAND DOOLABH, MD: Sure. We can use any valve through this operation.
00:41:17
BILL TURNER, MD: So you can use bovine, pig valves, mechanical valves, any type of valve to be placed in the mitral position you can use here.
00:41:25
NEELAND DOOLABH, MD: As well, we can do any repair technique through this hole.
00:41:27
BILL TURNER, MD: It looks like there's minimal disruption of the chest wall here. I can't really -- certainly no ribs are being broken. It looks like all you've done is gone between these ribs.
00:41:36
NEELAND DOOLABH, MD: We've just displaced them, kind of bent them out of the way essentially. There's no fractured ribs, there's no broken bones, nothing to heal essentially after this. Once the valve is in place, what we do here is with our suckers we make our way around the valve to make sure that the valve is seated in place properly, that there are no leaks around the valve. And at this point what we're doing is we're examining -- can we hold the video, please? -- we're examining this. This is the intraventricular septum. The right atrium is above us, the left atrium is here, our valve is in place here, and what we're looking for is a PFO, which is a patent foramen ovale. That is congenital hole in the heart that occurs in approximately 20% of the patients. If one is present, we simply close it. The other things we do at this portion is back here in this corner is the left atrial appendage, which is a famous area of the heart in which blood can collect, clots can form, and strokes can happen, particularly in patients that develop atrial fibrillation. So we routinely close that as well.
00:42:34
BILL TURNER, MD: So you close that on every case.
00:42:35
NEELAND DOOLABH, MD: Right. All done through the inside. At this point what we're starting to do now that the valve is in place is we make preparations to stop the fibrillation process. So the heart is now being warmed. We place our catheter with the carbon dioxide directly through the valve, displace any air that builds up in the left ventricle in between the muscle fibers and at this point start closing this left atrial incision. I don't think we have that

captured on video, but we close that. Once we're almost completely closed with that, we allow the right side of the heart to fill.
00:43:11
BILL TURNER, MD: Can you point out the valve for us, please?
00:43:13
NEELAND DOOLABH, MD: Sure. This is essentially from approximately 12 o'clock to 6 o'clock, so we're seeing the left side of the valve. The remainder of the valve is under this flap in this region here. So the valve is nicely tucked in place, and that's the beauty of our mobile retractor. As a surgeon, in order to view that corner, we simply just have our assistant slide over to that side and we can see it very well.
00:43:34
BILL TURNER, MD: That's a beautiful, well-seated valve.
00:43:37
NEELAND DOOLABH, MD: Most of our patients during the rewarming process spontaneously convert back to a normal sinus rhythm, as this patient did. I think we can play the video, please.
00:43:46
BILL TURNER, MD: And the CO2 prevents any air from being ejected into the system.
00:43:50
NEELAND DOOLABH, MD: Correct. It's all absorbed within the bloodstream, and it -- air is dangerous; CO2 is not, which is great. So now we're pretty happy with the heart valve, we make those preparations to come off. Back to sinus rhythm. This is the nice geometric pattern that we like to see.
00:44:06
BILL TURNER, MD: And it looks like the heart is ejecting here.
00:44:08
NEELAND DOOLABH, MD: Correct.
00:44:09
BILL TURNER, MD: Starting to get blood pressure back.
00:44:10
NEELAND DOOLABH, MD: You can see on our immediate Echo, the heart is still decompressed; however, this is the mitral valve that we've just placed, and you can see that the leaflets within the valve are moving quite nicely now. These are those stent posts that we had cinched down previously. And we get a good idea on this Echo that he valve is seated in place, that the leaflets work, that there's no intracardiac bubbles. We don't see any air within the heart. So looks like this lady's going to do very well.
00:44:38
BILL TURNER, MD: That's a truly amazing video. Nice, pliable leaflets, looks like you've got a well-seated valve there, and this heart is just begging to jump off the heart-lung machine.
00:44:48
NEELAND DOOLABH, MD: Oh, absolutely. What we do at this point is we now place drainage catheters, which are standard after any bypass operation. This catheter will go into the pericardium, or the sac that lives around the heart. This other catheter here goes into the right chest. So we just carefully place those catheters in place. We use these soft, flexible, pliable catheters to minimize the postoperative discomfort. At this point, as mentioned, the patient is now being actively warmed. We're making preparations for the patient to take over and make less reliance on the heart-lung machine. So what we'll do here is we'll evacuate any blood that builds up. This is actually the pericardium being closed. You can see the heart in the background, and we're closing that sac around the heart. You can see the drainage tube going in place. This structure here are the lungs, this pinkish structure. We evacuate any blood that's built up and return that to the heart-lung machine so it can be returned to the patient.
00:45:41

BILL TURNER, MD: So Dr. Sulser, you're inflating the lungs at this part and we're making final preparations for a landing, correct?
00:45:47
CARL SULSER, MD: Correct.
00:45:48
NEELAND DOOLABH, MD: So you'll see the lungs now become inflated here in just a second, and they should be coming up here soon. And there they go. So we're essentially done with the cardiac portion of the operation. Now we just turn our attention towards the groin and make preparations for decannulating the patient.
00:46:12
BILL TURNER, MD: Are there any special techniques that you use to minimize postoperative pain with that very small incision?
00:46:19
NEELAND DOOLABH, MD: What we do is, as you've done with the robotic cardiac operations, is freezing the nerve in that location. We as well use local anesthetic, or Marcaine, in that region. And preoperatively, Dr. Sulser often gives the patient a single shot of Duramorph in their back, which really makes a big difference.
00:46:42
BILL TURNER, MD: That seems to really help the patients postoperatively.
00:46:45
CARL SULSER, MD: Duramorph has been a big help.
00:46:47
BILL TURNER, MD: Okay, now, what are you doing here?
00:46:49
NEELAND DOOLABH, MD: This is the final catheter to be removed, the arterial catheter. We've made sutures into the vessels around these cannulas, so as we pull them out, we're not left with a gaping hole. We can immediately pull the catheter out and fasten the sutures in place. So at this point, the patient is completely off the heart-lung machine, the catheters are removed, and the patient is -- the patient's heart is completely self-sufficient. This is a view of the femoral artery as those sutures are being tied, and the femoral vein lives right here. Now the heart is fully functional, ejecting well, and now we get a great view at the valve and we see that there's no leaking through the valve, there's no leaking around the valve, there's no air within the heart, and the heart is truly very happy and squeezing well.
00:47:36
BILL TURNER, MD: Which is especially important if a valve is very heavily calcified. You want to make sure that it's seated into place and you don't have any leaks. Okay, what are we doing here?
00:47:44
NEELAND DOOLABH, MD: This is closing the chest incision. Essentially what we've done is we've placed one suture around the rib space that we open, one suture around the muscle, and now we're just closing the skin incision that we initially created. This patient did very well. She spent one night in the ICU, was off the breathing machine within several hours, and was discharged on postoperative day number three.
00:48:09
BILL TURNER, MD: Okay. Here's a question from the audience. Why are more surgeons not performing this procedure with a minimally invasive approach? And does it take longer to do this operation this way?
00:48:19
NEELAND DOOLABH, MD: Sure. It's difficult to answer that question. I think it comes down to a level of comfort. We're all trained to divide the breastbone, get full access to the heart, and this operation. This operation you saw requires different instrumentation, just a different mindset. Part of our reason for broadcasting this today is to get this out to other surgeons as well as patients to show that this can be done and can be done in a

reproducible fashion. As far as timeframe, our learning curve was essentially very slow -- excuse me, very quick -- in that prior to attempting an operation like this, I did all my open operations with these longer instruments just to get used to them. Our first operation took approximately six hours, but thereafter on our second surgery, we were back to our normal timeframe of about three hours or so. And now we're less than normal, meaning we're at about 2, 2 1/2 hours for this operation.
00:49:08
BILL TURNER, MD: With a sternotomy incision, we usually tell patients not to do any driving for about six weeks or to lift anything heavier than five pounds. What are you going to tell this patient here?
00:49:15
NEELAND DOOLABH, MD: Sure. What I truly ask them to do is for the first two weeks limit the motion of their right arm. They can lift anything up to about 15 pounds, and that just minimizes their postoperative discomfort. They're not going to hurt anything, but if they utilize that arm, they're just going to make their muscles work a little bit and hurt a little bit more. But beyond the two-week period, they're back to work, back to driving, back to doing the things that they want to do.
00:49:37
BILL TURNER, MD: So when can they resume normal activity period?
00:49:40
NEELAND DOOLABH, MD: Every patient's different, but on average, between two and three weeks, they're back to normal.
00:49:45
BILL TURNER, MD: And with the traditional operation, it's six, maybe eight weeks?
00:49:50
NEELAND DOOLABH, MD: Six to eight weeks, yes, sir.
00:49:51
BILL TURNER, MD: And this slide here, looks to me like it shows the length of this incision, which is very, very small, which is truly impressive. These drains here are flexible ones, they're not like the traditional big, hard, silastic drains, which are very painful when they come out. One of the things that shows the proof is in the pudding is when you talk to these patients after surgery. And I think we're fortunate tonight to actually have a patient that's interviewed. And perhaps we could show that.
00:50:26
INTERVIEWER: Just your thoughts on that.
00:50:28
PATIENT: My wife and I went to see Dr. Doolabh two weeks after surgery, almost to the date. And while we were there in the waiting room, my wife recognized the wife of a patient that had had to have had his sternum cut open because of everything that needed to be done to his heart. And I'm sitting there essentially like I am today. He was there and still had the pillow that you use to hold over your chest to help with whatever that helps. And it was like daylight and dark. This young man was doing well, but it was a very clear example of the differences. In other words, I looked like I could run a marathon, and he was carrying a pillow that he would hold over his chest at certain times. And when I saw that, I knew how blessed I was to have had the surgery done in the method that it was done in.
00:51:45
BILL TURNER, MD: Truly compelling testimony, and I hope the audience got to see that. Neeland, can you think of any other points that you would like to add or tell the audience about this operation?
00:51:58
NEELAND DOOLABH, MD: Sure. Essentially, I think the proof is in the pudding. These patients do very well. I think as you've seen here, that this operation is very reproducible. It can be done in a timely fashion. It's really cost-effective in that all the instruments that we

use are reusable. These patients have just done great. We encourage more surgeons to try it.
00:52:19
CARL SULSER, MD: Could I add something? I'm a little skeptical, having been trained in traditional cardiopulmonary bypass and always pleging the heart and stopping the heart, but I've been very impressed by how well the heart's preserved on bypass even under fibrillation with continuously being perfused by the coronary, as long as they have minimal coronary disease. And I've been -- we've done patients with ejection fractions in the low 20s, even the teens, and I've been very impressed with how wells they come off bypass, how well they do postoperatively with minimal amounts of inotropic drugs, so I'm impressed with the technique, that even in very, very sick patients, they do very well with this technique.
00:52:52
BILL TURNER, MD: We've seen this as well in our off-pump case series in that if you don't cross-clamp the aorta into private coronaries in their native blood supply, they're just going to do better. There's nothing better than cold, oxygenated blood. Blood is a many-splendored thing. We've got a lot of questions coming in. Looks like they're coming in from really all around the world. One wants to know, "Why does the skin around the surgery appear white when the rest appears yellow?" Yellow, I can answer that. That's the betadine. But I guess the --
00:53:22
NEELAND DOOLABH, MD: Sure. That's a great question. With any cardiac operation, in order to minimize infection, all of us have bacteria that lives in our skin, we routinely place an ioban, which is essentially saran wrap that's coated in betadine. Betadine fights infection. So the patient's chest is yellow because we've draped them in this substance. We then make a little hole within that in order to do our operation, but that's a great question.
00:53:47
BILL TURNER, MD: Have you had any wound complications with this operation? Have you had any infections with the small incision?
00:53:54
NEELAND DOOLABH, MD: We've had one lady that was moderately obese that had a [ficialis] drain in this location, but that resolved on its own. She went home without any antibiotic therapy, and it healed fine.
00:54:07
BILL TURNER, MD: The important consideration in my mind is with a sternotomy, if you get an infection there, that's a lot of morbidity. Mortality's even been quoted at 20% or greater. It would seem to me that if you got an infection in this incision, at the most all you would have to do is perhaps open it a little and drain it, treat it with antibiotics.
00:54:27
NEELAND DOOLABH, MD: Very minimal, not dangerous at all. And this lady, I think, really it was due to the rather large size of her breast and it was in a skin fold that was a little bit more moist than you would expect, and essentially, with minimal effort healed fine. As you mentioned, with the breastbone that's a terrible complication of heart surgery.
00:54:45
BILL TURNER, MD: Here's one that wants to know if this operation can be done in a child four years of age. And can you explain what happens if the septum is not repaired as well?
00:54:56
NEELAND DOOLABH, MD: Sure. I think four years of age is a little young for this. Again, we're -- the patient's anatomy is too small. These techniques have not been developed yet for congenital or pediatric patients. The question regarding the septum and its repair depends on what's wrong with it. Oftentimes patients that have rather large holes within their septum that are left for a long duration of time can be very problematic in that the heart develops abnormal shunting within the cardiac chambers as the pressure within the

lungs elevate and you can have irreversible problems. Tiny holes are sometimes left behind, but bigger holes we can't.
00:55:36
BILL TURNER, MD: Do you ever worry about keeping the heart fibrillating for a long time, say, if you're doing a complex mitral valve repair or perhaps even a case such as this where there's a lot of calcium? Is that bad for the patient?
00:55:47
NEELAND DOOLABH, MD: Not at all. Dr. Petracek, again, who taught me this procedure and has experience in over 700 patients, I think, has reported keeping a patient under fibrillation for at least -- for up to three hours. The reason it's not dangerous at all is, again, the danger with fibrillation is that the heart distends. And when the heart distends, it can't really supply blood flow to the inner portions of the heart. The reason why fibrillation is not dangerous in our case is that the heart's completely decompressed, the right side by the venous lines, the left side by our surgery. The heart's cooled, and I think you can go all day if you need to.
00:56:22
BILL TURNER, MD: Well, Neeland, this has been a fascinating presentation. I know that I've learned a lot. Carl and Warren, I appreciate your being here tonight. You've really shined a lot of light on this procedure. And I'd like to thank our audience for spending time with us tonight here at Mother Frances Hospital at the Center for Advanced Surgery and Technology. Good night.
00:56:45
ANNOUNCER: This has been a small-incision mitral valve repair performed from the Center for Advanced Surgery and Technology at Trinity Mother Frances Health System in Tyler, Texas. OR-Live makes it easy for you to learn more. Just click on the "request information" button on your webcast screen and open the door to informed medical care.
00:57:12
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