

**TOTALLY THORACOSCOPIC EPICARDIAL RF ABLATION FOR ATRIAL
FIBRILLATION
SUTTER HEALTH
SACRAMENTO, CA
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ANNOUNCER: Welcome to Sutter Health in Sacramento, California. Over the next hour, you'll see a totally thoracoscopic epicardial surgical ablation for atrial fibrillation. This webcast will feature the use of AtriCure minimally invasive products. Atrial fibrillation can lead to irreversible heart damage and stroke. In just moments, Dr. James Longoria and Dr. Larry Wolff will demonstrate this totally thoracoscopic single-prep approach. Dr. Longoria is helping to pioneer the next evolution of the epicardial surgical ablation procedure. Some of the benefits include smaller incisions to reduce post-operative pain and a quicker return to normal activity for patients. 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 join the doctors.

00:01:11

JAMES LONGORIA, MD: Good afternoon and welcome to OR-Live and Sutter Health in Sacramento, California. My name is Dr. James Longoria, I'm a board-certified cardiovascular surgeon of Sacramento Cardiovascular Surgeons Medical Group. Today we'll be providing viewers with a very unique firsthand look at an operation which treats atrial fibrillation. The procedure itself is known as a thorac-- totally thoracoscopic epicardial ablation, or as we term, a thoracoscopic Maze procedure. Joining me today is my co-host, Dr. Larry Wolff, who is from Sacramento -- from Electrophysiology of Sacramento, who is also the medical director of the cardiac electrophysiology lab at Sutter Memorial Hospital. Larry.

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LARRY WOLFF, MD: It's a pleasure to be here, thank you.

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JAMES LONGORIA, MD: We'd like to remind our viewers today out on the web that if they have questions, that they can go ahead and e-mail us by hitting the button of MDirectAccess, which is the link button on their website there. before we get into the actual procedure, I think one of the things that we need to clarify is what is atrial fibrillation? Larry, why don't you go ahead and tell us what atrial fibrillation is?

00:02:23

LARRY WOLFF, MD: Atrial fibrillation is, without question, the most common arrhythmia that we see today in this country. If one looks at the demographics, that it is clearly a disease process of aging. The first slide that lists demographics will show this. Somewhere between 2 and 5 million people have atrial fibrillation or have had atrial fibrillation. It affects about 160,000 people newly each year, and the estimates are that by 2050, 16 million people will have atrial fibrillation. If not an epidemic, it is an endemic. Looking at the next slide, we can see just how common it is in terms of hospital days. The reason that people get admitted to the hospital for arrhythmias, the green bar on the left shows hospital days for atrial fibrillation

compared to all other arrhythmias, and if you total up all the other arrhythmia days accounting for hospitalization, it hardly adds up to that which we see for atrial fib.

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JAMES LONGORIA, MD: So, Larry, let me interrupt you there. If you're talking about hospitalization for atrial fibrillation, is it fair to say that atrial fibrillation is the most common arrhythmia of the heart?

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LARRY WOLFF, MD: It's the most common arrhythmia that we see today, that we are dealing with. Truly epidemic proportions. If you look, the next slide shows the demographics by age. Clearly this is a disease of aging. The estimate is that individuals over 80 years of age have a 10% chance of having atrial fibrillation. This slide shows that the older age groups, though they represent a smaller percentage of the population, have a much higher percentage of atrial fibrillation compared to other groups. The next slide looks at what the clinical problems are that we see with atrial fibrillation. Far and away the biggest fear that we face in these individuals is embolism, stroke, transient ischemic attacks, or TIAs. Along with that is the anticoagulation that we provide trying to prevent that, and anticoagulation has its own complete set of problems, though it certainly does reduce the risk of stroke. Heart failure is an issue that we see. Rate-related atrial myopathies and dilatation. A sense of ill-being, reduced exercise tolerance, fatigue, et cetera; huge problems with atrial fibrillation. Next slide, please. People present with a variety of symptoms. I see people in the office who at times have no awareness that they have atrial fibrillation at all. That certainly is the minority. Most people are well-aware that they have atrial fibrillation. Palpitations, shortness of breath, reduced exercise tolerance, fatigue; all are important presenting symptoms for atrial fibrillation. Next slide, please. Who gets atrial fibrillation? Why does it occur? Well, there are both cardiac and non-cardiac causes of atrial fibrillation. And certainly when we're looking at cardiac causes, we want to rule out other potentially operative issues that we may have. We don't want to take somebody to the operating room trying to fix atrial fibrillation if they also have coronary disease without dealing with coronary disease or their mitral valve or their aortic valvular disease. In this country, probably the most common cardiac or cardiovascular cause of atrial fibrillation is hypertensive heart disease. Hypertension causes the heart to become a bit thickened, the pressures go up in the heart, the left atrium dilates, it stretches the little electric circuits, and one is left with atrial fibrillation. Coronary artery disease, valvular heart disease, and various cardiomyopathies. Next slide, please, shows the non-cardiac causes. Lung disease is a very important cause of atrial fibrillation, as are various metabolic causes such as thyroid disorder and electrolyte disorders. Alcohol is a potential cardiac toxin and may cause atrial fibrillation. Not listed on this slide are two very important causes that we have come to realize in the last few years for atrial fibrillation. One is obesity, which is an independent risk factor for the development of atrial fibrillation. And the other is sleep apnea.

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JAMES LONGORIA, MD: You know, Larry, before we -- why don't we get into why we're all here, which is to see this exciting surgical procedure which we are now performing at our facility. And before we actually get into the -- before we get into the actual video, we'd like to show a computer animation of what we perform. What we've done here is put together a computer-animated video. This is a Wolf Dissector. It is actually a firm, lighted tip on the end there which basically acts like a finger. As we are in there operating with a thoracoscope, which is demonstrated here through a very small port incision, this allows us to get behind the pulmonary veins and literally come up underneath so that we get in the correct plain so that we don't come up through the back of the heart because we can't see it back there. This is

then what's called a glide-path catheter. A flexible catheter is then advanced over that. The dissector is then removed and replaced with a bipolar radiofrequency clamp. This then will go around and surround the set of pulmonary veins and make an ablation line, which is an encircling lesion around the left atrium just at the orifices of the pulmonary veins. And this makes an essential Lasso lesion, which is demonstrated up in the upper-hand corner there. After removing that, you can see now the heart gets rotated around and you can see that it makes a true Lasso lesion, thereby isolating those sets of pulmonary veins. In addition, we also have a bipolar pen which we can also use to make ablation lines. The difference that's demonstrated here, Larry, and you could comment on this as well, is we have pulmonary vein isolation lines around both sets of pulmonary veins, but in addition, we use the pen and make connecting lesions, which are demonstrated here by the telestrator here. And we make a box lesion around the back of the heart, thereby enclosing both sets of pulmonary veins. In addition, we make a caval lesion, which goes on the right side of the heart, demonstrated by the blue, which comes all the way down around here from the superior vena cava down to the inferior vena cava. And then we also connect from the left side to the right side from here.

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LARRY WOLFF, MD: Jim, before you go on, let me just make one point here, and that is: why is it so important to isolate the pulmonary veins? Over the last five to ten years, it has become obvious to us that atrial fibrillation seems to start in the pulmonary veins. The reason today the thinking is that it does actually begin there has to do with the embryology of the heart and the pulmonary veins themselves. The veins form by an evagination or an out-pouching of the atrial wall into the lung. That drags with it atrial endocardium, so one has a heterogeneous clump of islands of atrial tissue sitting in the pulmonary veins, which are firing off independently. And when that fires off and brings a little impulse into the atrium at a vulnerable time, atrial fibrillation ensues. So the whole purpose of this pulmonary vein isolation is to prevent those impulses from getting into the heart.

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JAMES LONGORIA, MD: And I think what makes this procedure -- we can go ahead and run the animation now which continues -- continues on -- is that we make these lesions and we're able to do these things through a port incision, which prior to that required us to have a full sternotomy and then also go on cardiopulm bypass with the heart arrested to form these lesions, usually intracardiac.

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LARRY WOLFF, MD: What we're -- what we're looking at here is ganglionic or stimulation of the heart tissue, looking for ganglionic plexi. We're pacing at 1,000 beats per minute. You can see the high-frequency stimulation. And when we are on a ganglionic plexus, heart rate slows precipitously, there's a profound drop in heart rate. That area is then ablated with radiofrequency energy which is generated by a generator and ablates that tissue. Pacing at a high rate following that then shows no slowing, indicating that we in fact have abolished the ganglia.

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JAMES LONGORIA, MD: And, Larry, why is it important that we are able to focally ablate these areas once we test them?

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LARRY WOLFF, MD: The feeling today is that these neural plexuses, or plexi, are important in the initiation of atrial fibrillation. Aside from the islands of tissue in the pulmonary veins, various areas within the atrium themselves also may cause atrial fibrillation. We think that that may be neurally mediated, so by abolishing these plexuses, or plexi, we think we can eliminate that.

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JAMES LONGORIA, MD: Excellent. Well, I think what we should do now is to go ahead and start on the procedure, which we have intraoperative video. We want to remind everybody that, again, if you have any e-mail questions during the procedure, that you can use your MDirectAccess and send those to us. Here we're seeing that there's a skin incision. The patient is asleep, of course. We have a double-lumen endotracheal tube and we start on the right side, and the right lung is deflated here. You can see that we introduce a 12mm thoracoport, usually in the fourth intercostal space in the midaxillary line. And then there is humidified carbon dioxide insufflated, which does two things. One, it keeps the patient warm as well as keeping our scope warm; allows for better visualization. The beauty of having the thoracoscope is we can see everything inside, and what we're doing is -- then these are the four ports total that we use on each side. This is on the right side there. And that's the extent of our incisions. The next segment demonstrates what we do in terms of once the lung is deflated and the pericardium is opened. We will then get to the structures, especially the right pulmonary veins. What you'll see here is the -- the pericardium, which is the fibrous sac surrounding the heart, which we all have. There's a small amount of fluid, the pericardial fluid, which is that clear fluid you see there, which is normal in all hearts. And what we do is see -- as you can see, there are three instruments in there. I have my physician assistant who is assisting me, but utilizing the scope, it allows all four hands to be working, which is a distinct advantage over working over a very small incision that only one surgeon can look through. One of the things that we do is open the pericardium widely above the superior vena cava, which is here. In addition, we also want to avoid the phrenic nerve, which is seen down here as well and courses along. And as you can see, that can be injured during dissection, but we see it obviously and don't make that mistake. Here we have an -- what's called an endo stitch. It is a specially designed suture which has a needle attached to a suture, which we will use as a traction suture to retract the pericardium away from the veins, from where we'll be working. It has an internal transfer device which transfers the needle from one jaw to the next, making it a very safe delivery within what we're doing. This is then brought out through one of the port incisions, and literally now what you see is the superior vena cava. This is the traction stitch being brought out, and once we get that in place, it'll allow us to visualize the right-sided pulmonary veins. You can see the aorta here in the background. So you can see that this is, although a minimally invasive procedure, it is still open-heart surgery. Here we have -- to orient everybody, we have the inferior vena cava marked by the X there. We are now in the oblique sinus, which gets us behind the heart back in here. And the pulmonary veins are entering into the left atrium, demonstrated by the arrow. We take down the pericardial reflection to the pulmonary veins, which will allow us access to the back of the heart. You see that we -- you notice that we do use a lot of Dacron-coated soft-tip applicators called endo Kitners because we can put a hole in the heart. Here we are now above in the transverse sinus. The superior vena cava is above us. The right-sided pulmonary veins are down below. And what we are doing now is opening up this transverse sinus, which, it allows us to look behind the superior vena cava, behind the aorta, and get a window into the left side, which is here. We are not inserting the Wolf Dissector, which you all saw with the computer animation, and it has a lighted tip. And what we do is then flex that tip behind the heart and behind the pulmonary veins so we get access and are able to pass that catheter around. And one of the things you will see is the light here. This takes a couple of minutes, and so we'll continue the video running, and we should probably talk and have Dr. Wolff discuss -- you know, what we don't want is for people to think that surgery, Larry, is the only option and may not be the first line of therapy. So why don't you go over

the therapeutic options that people have, patients have, when they have atrial fibrillation.

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LARRY WOLFF, MD: Treatment of atrial fibrillation is an individual, patient-specific phenomenon. It's time-intensive. Every patient has their own story and needs to be dealt with individually and specifically. First and foremost, anticoagulation is important to try and prevent clot emboli. And there are certain risk factors that put people at greater risk for having emboli: age greater than 65-75 years of age, hypertensive heart disease, prior stroke, diabetes, heart failure all make stroke more common and more frequent. Anticoagulation is critically important in the treatment of atrial fibrillation. Antiarrhythmic drug suppression is important and historically has been used. There are a variety of antiarrhythmic drugs, some more or less toxic than others, trying to maintain sinus rhythm. None of them are terribly good, but for some individuals, drug therapy clearly works. And if people are willing to take the drugs and can tolerate some side effects, it is certainly a reasonable choice. Catheter modification or ablation of the AV node with concomitant pacing is something that we've been using for about 15 years. That does not get rid of the atrial fibrillation, it simply controls the rate and gets rid of the symptoms. Those people certainly need to remain on their anticoagulant therapy as well. Nothing that I've mentioned so far, however, really cures atrial fibrillation. It's all kind of a controlling process. The two approaches to curing atrial fibrillation are both ablative in nature. One is a catheter ablation, which has been evolving over the last five or six years. And finally, surgical ablation, including initially the Maze procedure as made famous by Jimmy Cox at St. Louis all the way up to what we're looking at today, that is the thoracoscopic Maze.

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JAMES LONGORIA, MD: So now if we are to get back to the video, we have gotten behind the heart, and now we have actually removed the Wolf Dissector and inserted it from a cephalad position down to the caudad position. Basically from a head position down inferiorly. And you'll see the lighted tip come around at the base. And -- but it has now on it, as depicted in the animation, it has that glide-path catheter, which is a very soft, flexible catheter which has a red rubber catheter attached to it which then attaches to our ablation device. And this then is passed through and the Wolf Dissector is then removed. And what you'll see now is -- what you'll see now is the red rubber catheter coming in onto the video. We'll go ahead and roll to the next video, Larry, which demonstrates now us using the -- utilizing the pen device, and so one of the things that we have done is to ensure that we have either unidirectional block if the patient is in atrial fibrillation or bidirectional block if we are able to get them -- if they are in a sinus rhythm. And here we have the bipolar pen, and we are now going to, what we say, pace, sense, and stim. And, Dr. Wolff, maybe you can speak more about what we're doing here.

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LARRY WOLFF, MD: Well, we already alluded to the fact that we high-frequency pace over various portions of the atrium looking for the ganglionic plexi. That's partly what we're doing here. The other thing we're doing is we are looking for electrical signals on either side of our ablation line. We want to make sure that the line is complete and transmural and that electric impulses are not traversing that line. Once we have assured that the electric impulse cannot traverse the line, we're pretty sure that the impulses from the pulmonary veins will not get back into the atrium, causing atrial fibrillation, as we had discussed before.

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JAMES LONGORIA, MD: I think one of the important things, Larry, is that when other surgeons have proposed that we just perform as surgeons pulmonary vein isolation, which is just an encircling lesion around both sets of pulmonary veins, and I think

what sets our system apart is we have a very integrative and collaborative approach between yourself, an electrophysiologist, and the other electrophysiologists and myself in terms of determining the causes and to determine exactly confirmation that what we're doing is actually correct. And so what we're doing here now is the high-frequency stimulation, which you can see the heart in the background is responding to, and then we look for the response as previously demonstrated. And actually, Larry, since this is here, perhaps we should go to slide number 19 --

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LARRY WOLFF, MD: Seventeen. Seventeen.

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JAMES LONGORIA, MD: To slide number 17 in terms of what type of patients decide to come to have an operation.

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LARRY WOLFF, MD: Good question. The ideal patient for this procedure is symptomatic with their atrial fibrillation. They don't feel well with it, they're short of breath, they're fatigued; whatever their symptom is, they're symptomatic because of it. They have proven intolerant to antiarrhythmic drugs or antiarrhythmic drugs don't work. Or they cannot take anticoagulation for one reason or another. We've already had two patients, you and I, who have had absolute contraindications to coumadin therapy. One because of a bleed in her brain, the other because of GI bleeding. These people simply cannot take coumadin. They have to be anticoagulated if they have atrial fibrillation, they cannot be anticoagulated, therefore we have to cure the atrial fibrillation. This is the perfect procedure for them. Finally we want to make sure, and we discussed this earlier as well, that these individuals do not have concomitant heart disease, valvular heart disease, coronary artery disease. If they do, obviously we don't want to do this with thoracoscopic approach but rather the traditional sternotomy approach so that everything can be fixed at one time.

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JAMES LONGORIA, MD: Which we are capable of performing currently today, and do it readily. You know, I think one of the things that we've talked about, these ganglionic plexi, and for our professionals out there, some wonder where are they, what do they do? And I think one of the things, we can go to slide number nine, and then Dr. Wolff can -- why don't you let us know, what are they, Larry? Let us know.

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LARRY WOLFF, MD: Again, these ganglionic plexi are a group of nerves that sit on the surface of the heart. They release acetylcholine, a neurotransmitter, when they are stimulated. Acetylcholine is a very potent AV-nodal blocker. It also tends to slow down the sinus node as well, and it's why when we stimulate these ganglionic plexi, the heart rate drops away to almost nothing. We don't stimulate very long at 1,000 paces per second because obviously we don't want these people to have -- have no heart rate. Again, we want to abolish these ganglionic plexi because we think that they're important in the initiation of atrial fibrillation. And they are at various places in the heart, as one can see from the slide.

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JAMES LONGORIA, MD: Actually, I think -- you know, Larry, you and I both know, because we understand anatomy, but for the -- for the general public out there, you know, I think we have a schematic which is on slide number 10. So I wanted to reiterate, and Dr. Wolff can demonstrate these, that we have these circles and dots there, but those have been mapped.

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LARRY WOLFF, MD: Exactly right. These are mapped, and we put the pen on these various places. Dr. Longoria puts the pen on, he tells me where he is, I turn on the stimulator, and we either have a response or we don't have a response. If we have a

response, he keeps the pen there, we flip a switch, turn on the radiofrequency generator, and cauterize or abolish the bit of tissue that's there. We then retest right at that spot to document that in fact we have achieved the effect that we want. And all these little blue dots are areas that we go to. Let's go to the next slide. This is the right side. The next slide shows the left side. And --

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JAMES LONGORIA, MD: I think, you know, what has been demonstrated, if we want to go back to the video now, is we're placing the bipolar radiofrequency clamp. And as you can see, the red rubber catheter is leading the tip behind the heart and allowing us to come through those two openings, the transverse sinus here and the oblique sinus down here, and allows us to get behind the heart. And you can see the posterior tip coming into view here. And one of the things that we want to ensure is that we're on the atrium, that we aren't on the veins themselves, because although there's atrial tissue which extrudes into the pulmonary veins, we want to be sure that we are truly on the atrium to make these ablation lines. And again, I make the point that, you know, in addition to this, Larry, you know, we have done spot ablation for the ganglionic plexi because of the fact that the bipolar clamp may not include all of those areas that we have tested, and I think you can confirm that.

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LARRY WOLFF, MD: Exactly.

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JAMES LONGORIA, MD: So what we do is, after we place the device, we are actually ablating right now. It's a very quick process and works rather rapidly. We test that, and Dr. Wolff is looking at the monitor here. We're actually looking at --

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LARRY WOLFF, MD: This is the radiofrequency generator looking at the impedance -- it did look at the impedance. And once we see that the impedance, that flow drops, current drops, we know that we have a transmural or full-thickness burn, which is what we're after.

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JAMES LONGORIA, MD: And with that, that line, that encircling, is through the length of the clamp itself. But one of the things that we do do is to fulcrum and move the clamp such that we get overlapping lines. You can see the ablation line, which is underneath, but in addition to that, we want to ensure that it is a full encircling lesion.

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LARRY WOLFF, MD: I want to make a point here, Jim, as well. The beauty of this clamp is that one gets a truly contiguous line of ablation. Prior to this, using a catheter, one would have punctate, or point, lesions. And you can see the difficulty in getting a true transmural line that is full thickness and completely contiguous.

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JAMES LONGORIA, MD: That's correct. I think one of the things that we have talked about is that, you know, surgery draws a line like this, and in the lab, unfortunately, the technology hasn't caught up. The electrophysiologists have to draw a line like this, which, as you know, takes a lot longer.

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LARRY WOLFF, MD: And it's not even so much about time, it's just about efficacy. We simply can't get the line that you can get. The other beauty of this pen is that Dr. Longoria is able to paint with this -- with this pen along the surface of the heart while radiofrequency energy is being applied.

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JAMES LONGORIA, MD: And as you can see here, we're making the caval lesion, which is really on the right side of the heart. It's along the right atrium from the

inferior vena cava down here to the superior vena cava, which is up here. And we've also already connected from the lower lesion, from the right inferior pulmonary vein upward. Now one of the things that we have done is have now included not only paroxysmal patients but persistent and permanent patients. That's the classification of atrial fibrillation that we will go over later. And one of the things that we are doing is making connecting lesions. And again, Larry, maybe you can talk about the connecting lesions. Here we are demonstrating that we're going actually underneath the heart and then above on the left atrial -- the dome of the left atrium. Again, when you look over here, you're looking at the left atrial appendage, which we will ultimately remove. But we are then going to make these connecting lesions.

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LARRY WOLFF, MD: The connecting lesions, just for the sake of the audience, connects the two pulmonary vein encircling lesions to one another. It's important to fully isolate the antrum of the left atrium. It's also important to prevent macroreentrant arrhythmias that occur fairly frequently with catheter ablation on the left side of the heart. And we're going to talk later about the fact that right-sided atrial flutter is fairly common in these patients, and it's a fairly quick fix in the electrophysiology laboratory. It's an outpatient procedure, but with some frequency and regularity, we're seeing patients come back with right-sided flutter after being treated with the thoroscopic procedure. In the old days, we saw left-sided flutter before the connecting lesions were made, and that's a much more difficult arrhythmia to handle.

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JAMES LONGORIA, MD: Larry, do you think it's possible that people have underlying atrial -- right-sided atrial flutter that is masked by the atrial fibrillation?

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LARRY WOLFF, MD: I do. I do. In fact, sometimes in the EP lab, we see patients with one atrium fluttering and the other atrium fibrillating. And it depends which one is dominant. But I've seen -- I've seen it happen.

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JAMES LONGORIA, MD: I think the importance of what we're doing here with the connecting lesion, which you can see on the video, is the pen allows us -- has a time sequence because this has been measured and documented in pre-clinical stages as to the thickness of the atrium and how long we actually have to place the pen on there. So I think we want to reiterate to the viewers that we're not just haphazardly painting along the atrium. These are timed events that are being measured throughout. Now here is one of the unique things that we're able to do with the thoracoscope, and we're actually peering into the backside of the heart, on top of the atrium, underneath the aortic valve, which is up here. And that allows us to get to this area here called the fibrous trigone, which is the kind of the fibrous skeleton of the heart. And this connecting lesion down to the fibrous trigone is important because it will prevent left-sided flutter, which we have yet to see in our patients, thankfully. I think one of the beauties of the thoracoscope is that it allows you visualization. It allows all four hands to be working, myself as well as my assistant. I think one of the things that -- so basically, this completes the right side. And then Dr. Wolff --

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LARRY WOLFF, MD: The left side. Oh, the right side.

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JAMES LONGORIA, MD: Correct, the right side. We're talking about the right side of the chest, and completes the right side, which is really the left atrium. We then will go over to the left side. We will then inflate the right lung, we will deflate the left lung, and do similar port incisions on the left side and finish the procedure. And

again, we'll go ahead and start rolling that video, which demonstrates the port incisions which we've already placed which are very similar orientation as to the ones on the right side. And one of the things you'll notice here, for the surgeons in the audience, is the phrenic nerve is here. On the right side, the phrenic nerve was much lower and we went above the phrenic nerve. Versus on the left side, it runs lower, but because we need to work below this area, we're going to make our pericardiotomy below the phrenic nerve. And one of the things you have to do is to dissect off the phrenic nerve away from this vein, and there's plenty of room up there, but that does take a little bit of time to get that phrenic nerve isolated off because it controls the diaphragm which, although you would have to cut it to truly injure it, there can be some palsy of it and therefore get the patients to have some sensation of breathlessness after the operation if it were injured.

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LARRY WOLFF, MD: Jim, you mentioned time. How long does this take?

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JAMES LONGORIA, MD: In terms of, we have now gotten the whole procedure, skin-to-skin, with these extensive lesion sets, we've gotten it down to just over two hours now, which includes all of the testing and confirmation with Dr. Wolff's assistance, and which would make this procedure for most patients, patients get extubated immediately afterward. They're in the recovery room for about an hour, and then because of habit, we have been putting them up in the intensive care unit, although we're considering placing them out on the telemetry unit just for monitoring. Here we see that we're making the pericardiotomy, which goes posterior. One of the things you can see in the background here is the beauty of the thoracoscope, which you can see. You can see how it is actually a very bright picture. It's almost like HD, which is kind of nice. Again, we are taking the pericardiotomy up pretty high, and one of the things you'll see here up here in the corner here is the ligament of Marshall right there. And perhaps Dr. Wolff can tell us about the ligament of Marshall and why that is such an important landmark for us.

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LARRY WOLFF, MD: That is a vestigial structure which was at one time the vein of Marshall in utero, and it is a source of arrhythmia. At times, people have accessory pathways that are found there, and they conduct electricity. They conduct current, and allows for reentrant rhythms. We have seen already at least one case of atrial fibrillation that disappeared with ablation of the ligament of Marshall. So it's an important structure to identify and try to abolish.

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JAMES LONGORIA, MD: We are able to, as you can see with the videoscope there, thoracoscope, that you get excellent visualization of it. And it is extremely important to divide the ligament of Marshall from the pulmonary artery down to the left atrium and divide it completely because we will then dissect this area in the back here, which will allow our Wolf Dissector to come around to get isolation around the veins. But the ligament of Marshall, I think, is one of the key structures that we ablate, and you'll see we're actually burning it, cauterizing it here, which is performing the same thing by dividing it. And we spend a fair amount of time ensuring that that is completely divided. As Dr. Wolff has said, we have seen actually one patient on the table that as soon as we divided it, they went into sinus rhythm without any further ablation and remained in sinus rhythm after that. So after we divide that structure, we then get again behind the heart over here and free up the pulmonary veins on the left side. Again, the next clip is going to demonstrate how we again place the Wolf Dissector inside and behind the left-sided pulmonary veins. And once again, we will then pass the Wolf Dissector and get it set up again for our testing, which is already done here. You can see that we have the bipolar pen here, and again, Larry,

we're going ahead and do the high-frequency stimulation of the ganglionic plexi. And actually I don't -- I'm not sure if anyone notices, but I believe our patient is in sinus rhythm at this time, is that correct?

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LARRY WOLFF, MD: It looks like it.

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JAMES LONGORIA, MD: I think it is, yes. And so in the meantime, you know, we have divided the ligament of Marshall, we have done some focal ablation, and our patient, if you'll notice in the background here, is in sinus rhythm. Again, Larry, maybe you would like to talk about the -- oh, this is a great -- this schematic here.

00:39:52

LARRY WOLFF, MD: This actually isn't a schematic, this is real-time. This shows atrial electrograms with the pen on the atrium itself. And one can see the chaotic atrial rhythm that occurs and the ECG above that, the surface ECG. Here's a slide showing what happens when we use high-frequency stimulation over the ganglionic plexus. The high-frequency stimulation is the part of the ECG that looks like it's obliterated up at the top. At the bottom, you can see the arterial pressure. And the pressure simply goes away. There's no heartbeat at that time. We turn off the stimulation and the heartbeat comes back. And again, that's due to the release of acetylcholine from the ganglionic plexus.

00:40:45

JAMES LONGORIA, MD: Now again, we're showing the Wolf Dissector coming around, and while -- while we're doing that is -- actually, Larry, we've got a question from the audience. And why don't I propose this to you? It says: is this procedure available to me if I've had a catheter ablation and still have atrial fibrillation episodes?

00:41:09

LARRY WOLFF, MD: Absolutely. Again, as we pointed out before, the problem with the catheter ablation is really twofold. One, one does not achieve a truly contiguous line of ablation, so there probably isn't a line of block. The other huge advantage which we have not talked about but which we have to talk about is the fact that with this procedure, the patient has a left atrial appendage appendectomy. Vitaly important. Most of the stroke that occurs with atrial fibrillation comes from clot that rests within the left atrial appendage. During the last part of this procedure, you will show how you remove the left atrial appendage, removing that source of clot. And that certainly doesn't happen with a catheter ablation. So the answer to the question is absolutely. Patients who've had catheter ablation that failed are still excellent candidates for this procedure.

00:42:01

JAMES LONGORIA, MD: I might add that we have thought perhaps that there would be scar tissue or some other things that would prevent us if they've had an endocardial ablation, but as Dr. Wolff can testify, we haven't seen that. And we've actually operated on now a fair number of patients that have had a prior endocardial ablation. And so here we have the bipolar clamp, which is now around, and you can see, this is post-ablation, and it's obvious where the ablation line is that you can see there. And we are now then testing to see that we have unidirectional block here, sensing any atrial electrograms on the pulmonary vein side over here versus the atrial side, which is over here above the line. And again, we can't speak to how vitaly important testing is because we have been in on several cases where we have ablated and ablated and ablated and Larry has told me, "Nope, you don't have isolation. Nope, I'm still sensing signals, go back and ablate and ablate and ablate." And we have and subsequently achieved that. And I think that's one of the reasons

why we have success. And here you can see -- Larry, why don't you speak toward what we're seeing here on the monitor.

00:43:19

LARRY WOLFF, MD: Simply shows sinus rhythm, which is the goal of this procedure.

00:43:26

JAMES LONGORIA, MD: And at the very bottom there. So what we're doing now is finishing up those connecting lesions, which -- so now we've lifted up the bottom side of the heart and looked to see where we ended from the right side. And now we're using the pen and basically connecting those lesions over to our new encircling lesion around the left-sided pulmonary veins. And again, I think that's the beauty of the pen is it allows you to connect those lesions very heartily and readily, as you can see. The lesions are very distinct, so... You know, we actually have another question from the audience. It says: so far, for whom is this procedure best indicated and what are the success rates? So, Larry, I think you can speak toward who it's indicated for.

00:44:19

LARRY WOLFF, MD: Well, again, we're looking for people who have symptomatic atrial fibrillation who have tried medicine, preferably more than one medicine. The medicine either doesn't work or is not well-tolerated or they cannot take anticoagulant therapy for one reason or another. We're looking for people who have not had open-heart surgery in the past. If you've had open-heart surgery, this approach really does not work; there's scarring in the chest and it just -- it's dangerous and is just not feasible. So we're looking for someone with atrial fibrillation in whom medicine doesn't work or is not tolerated who has not had open-heart surgery.

00:45:05

JAMES LONGORIA, MD: And I can speak toward the success rate. You know, when we have looked at our patients, we have divided them up into paroxysmal patients, which we are 12 for 12. There is one patient that ended up having bradycardia, which ended up having to require a pacemaker, atrial pacemaker. But when we look at patients that are in the persistent and permanent, they are currently being worked up, but our success rate overall is greater than 80% from a surgical perspective of getting these patients into sinus rhythm. Now here is, I think, the most important thing as surgeons that we have to offer. And as you can see, this is -- this is your atrium fibrillating. You can see the difference in the activity. And this is the source of the majority of the clots which have a potential of embolizing and causing a stroke and going to your brain. And this, as Dr. Wolff has said, is vitally important to remove. And what we do is we take a stapling device and we come across the base of that appendage, and under echocardiographic guidance, then look to see that we have occluded it at the base. And we ensure that we haven't gotten any other structures in the backside of the staple line, and then we occlude that. And you'll see that this is now -- the left atrial appendage is now decompressed. And what we first do is fire what's called a no-knife stapler. It basically lays down three rows of staples without cutting the appendage. And that is -- those staples are being fired now. One thing to note is that this is what's called a parallel closure jaw, meaning that the jaws close inward like this rather than as a scissor, which closes like that. And that's important because it has to compress the atrial tissue, and you'll see that that's what we're doing now. And removing that, and it lays down those rows. And therefore, the orifice of the appendage is blocked and occluded right there. One of the things that has been shown is that even though you've occluded the appendage, it still can act as a focus, the orifice can, for macroreentrant circuits, so therefore we fire another staple row across to ensure. And one of the things that we always do is to check the echocardiogram to ensure that we're not too close and not too far away and look.

But this is really -- this line of staples is really an insurance policy because we don't want any bleeding back there, which could be troublesome to say the least. One of the things that we will do is afterward I also do want to thank our audience which is next to us. We will be, after we finish here, be available for more question-and-answers locally. For those that have further questions, the webcast will be archived and you will have information as to how to contact us if you want more information with regard to this procedure. Now finally, we then insert a stapling device that has a knife inside of it. And this will then remove the atrial appendage, which we're going to show here. And although some have advocated that you could just leave the appendage and it will just wither away, I think it's one of those surgical things. It's like you could always tie off the appendix in the belly, but there's always something about taking it out, which is what you really want to do. And so that's what we're doing here. And we ensure that we don't get any of the staple lines intertwined. And now we're able to grasp the appendage, which you'll see, and actually pull it into the staple device. We wouldn't be able to do this before because it wasn't decompressed. And essentially, we want to then fire the stapler line across and remove that. Actually, while we're doing this, I think one of the things that we may do is to go to the different classifications. We've been bantering about the different classifications, Larry, of atrial fibrillation, and perhaps what we can do would be to go to those right now.

00:50:09

LARRY WOLFF, MD: We break atrial fibrillation up into several different types. Paroxysmal occurs on a paroxysmal basis. Typically it self-terminates within 48 hours. Persistent, intermittent, does not terminate and requires some sort of intervention. Then there's permanent, or chronic, typically that lasts longer than a week. The type of atrial fibrillation that one has predicts what they will have in the future. Atrial fibrillation begets atrial fibrillation just as sinus rhythm begets sinus rhythm. The natural history of atrial fibrillation is that an individual has it paroxysmally, it occurs now and then. They have it more and more, it lasts longer and longer, and eventually they're in it chronically. And that's what we're really trying to prevent and avoid.

00:51:01

JAMES LONGORIA, MD: So it's safe to say that atrial fibrillation is a continuum. When once you kind of start and get a paroxysm of atrial fibrillation, left untreated, it will ultimately become --

00:51:15

LARRY WOLFF, MD: Can.

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JAMES LONGORIA, MD: Can become.

00:51:17

LARRY WOLFF, MD: Can. There are individuals who may have atrial fibrillation once and never have it again.

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JAMES LONGORIA, MD: One of the things we're going to get to the piece de resistance, as we call it, is we're removing the appendage. As you can see, the staple -- the line -- the knife didn't cut all the way through the appendage or what remains of it, and so we just bring in a pair of what are called endo shears and go ahead and remove the last piece, which is easily done and removed. And I believe I have to invoke one of the things I was taught which is, "if it looks good, it probably is good." And so this little thing hanging off here just didn't look good, so we had to go ahead and remove it. We check the staple lines and make sure that they were across and decided we should probably remove that as well and are completing the procedure here with the removal of the last bit of appendage. One of the things we didn't show

was, you know, you have the four port incisions on both sides. Since the lungs are deflated, we leave in two small drainage tubes called chest tubes which drain fluid which can accumulate as well as any remaining blood which might have accumulated as well, although a very small amount. And we usually get those out on the second day. But after the removing of the appendage there, the Maze operation is completed.

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LARRY WOLFF, MD: I think it's important to point out, too, Jim, that patients typically do not get blood transfusion with this, and it really is not open-heart surgery in the classic sense. Though you are excising part of the heart, the left atrial appendage, it really isn't open-heart. You don't open the atrium or the ventricles or the aorta.

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JAMES LONGORIA, MD: That's correct. I think one of the things is I don't want people to think that minimally invasive doesn't mean minimal risk. There's always a lot of risk, but you know, we do this every day. It's an everyday experience for us. And I -- so that completes the operation as it is, and I think one of the things now before we wrap up, we'd like to extend a welcome to Derek Galishote, who's actually one of our patients who has undergone this procedure.

00:53:40

LARRY WOLFF, MD: And who flew down from Seattle for this.

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JAMES LONGORIA, MD: Who flew down from Seattle. He is also a physician assistant and is very knowledgeable of medicine, of course. And flew down to join us today. Derek, thank you for joining us today.

00:53:56

DEREK GALISHOTE: Thank you for having me.

00:53:57

JAMES LONGORIA, MD: I think what -- what people want to know is, you know, when did you develop atrial fibrillation, how did it develop, your symptoms, what have you tried, what didn't work, why did you decide to do this? Basically, your story and how you came to us and whether or not, you know, you're in sinus rhythm, which I know you are, but how the whole experience was. I think that's what we want to know.

00:54:21

DEREK GALISHOTE: Sure. Like -- like most patients, I was totally healthy, and then out of the blue, acute shortness of breath and just profound fatigue. Sought care and was noted to be in atrial flutter. Ended up undergoing a cardioversion and then a subsequent catheter ablation for atrial flutter, and that was successful in the sense that I had loss of all my symptoms for about two years. And then a similar event just like the original. Again, profound shortness of breath and immediate fatigue. And having undergone it previously, figured it was that, and sure enough, I was in atrial flutter again, a combination of fib and flutter. Underwent a second cardioversion and then a second catheter ablation addressing the right side. And that was successful as well. Was able to return to all of my athletic activities and really was symptom-free for about two more years after that. So about five years into this process, feeling again rather healthy and able to do everything, slowly started to develop the shortness of breath with just walking, climbing stairs, and then through athletics, found that I had no exercise endurance at all and just didn't feel right.

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JAMES LONGORIA, MD: At that time, were you -- were you having daily events, weekly, minutes, hours? What type -- how long were those?

00:55:47

DEREK GALISHOTE: Symptom-free until clearly very identifiable for myself when I went out of rhythm. And at that point, I kind of didn't want to admit it but knew something was going on and went for a week or two with the symptoms and then just knew that things were not the way they used to be.

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JAMES LONGORIA, MD: Larry, does this sound like a familiar patient scenario, or --

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LARRY WOLFF, MD: Well, as I said, every single patient is different. I've heard this 100 times, but I've heard every other story 100 times, too. As the very first slides indicated, this is incredibly common. And there are fairly common stories that you hear. So sure, this is common, but so are people who have no symptoms and terrible symptoms. You see everything in between.

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JAMES LONGORIA, MD: So, Derek, you're up in Seattle, you're getting these attacks as we call them, and then you come to Sacramento.

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LARRY WOLFF, MD: How'd you hear about us?

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DEREK GALISHOTE: Well, I, you know, went back and saw my practitioner and found out that I was clearly in atrial fibrillation again, and through previous discussions, we knew we would likely have to address the left side of the heart to really provide a cure. And met with the electrophysiologist and set up a program that we were going to follow through, went on some medicine for a period of time which clearly slowed my heart rate down but didn't allow me to pursue any activities. And at that point, as any good consumer, I got on the internet and started to do some research and found out more about the cath-- about the surgical ablation and then, through family, found out there was a program here in the Sacramento area and did a little further research and then, fortunately, was able to get an opportunity to get down here and become evaluated.

00:57:38

JAMES LONGORIA, MD: So you obviously decided to have the procedure. It's been successful to date. How long were you in the hospital?

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DEREK GALISHOTE: I was in the hospital for three days.

00:57:48

JAMES LONGORIA, MD: Overall, a painful experience? Has now resolved? Back to activities? Where are you now?

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DEREK GALISHOTE: As one would expect with any type of surgery, though they're small portals, you know you had surgery. But certainly after a couple days, bearable and nothing that I would call really long-term. By the end of the first week, the acute pain was gone but more of just the overall fatigue. You know you've been through a surgery, but being able to be up and around and doing everything with really minimal pain symptoms was really quite exciting and not what I expected at all.

00:58:23

JAMES LONGORIA, MD: Now I do know you've had two short-term episodes of atrial fibrillation since your operation. Larry, is that a common scenario again?

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LARRY WOLFF, MD: Very common. Very common. I think in the first three to six months, until all the scarring is complete, it's typical to see atrial fibrillation.

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JAMES LONGORIA, MD: And I think one of the things that we need to reiterate is that everyone considers success at six months, and so, Derek, you know, as you know,

we've put you under what's called a surveillance program which Dr. Wolff has established for us to ensure that we make sure that at six months we will have success. And that's what I think we're looking for, so any words of wisdom to possible future patients or anything else in terms of things we could've done better?
00:59:14

DEREK GALISHOTE: The main thing I'd just -- seek out care. There are a lot of new things happening out there. I didn't know anything about this a year ago. I'm quite knowledgeable now and certainly would recommend it as a potential operation for many of those that have my similar kind of symptoms and situation.

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JAMES LONGORIA, MD: I think one of the things, before we wrap up, that we should address is the -- this procedure, as we've done, is exactly as Dr. Cox has devised. At least, that's what we think, yet -- and Dr. Wolff knows this -- is that, you know, we are in the very early stages of this and we hope to achieve that same amount of success. But, Larry, anything else that you see that we should be doing, could be doing?

01:00:05

LARRY WOLFF, MD: No, but I want to -- I want to make this point that as an electrophysiologist, I do all kinds of ablation. I will ablate anything that is ablatable, but I don't do atrial fib ablations. I think that the success rate -- and one study that just came out showed a 28% success rate at 26 months with one trip to the EP lab -- does not, in my mind, allow us to face the risk of catheter ablation. Atrial fibrillation is a huge problem. It's the most common thing that I see, and it wrecks people's lives at times. I am so excited to have a procedure that I think works, that has a very acceptable complication rate. The complications that we've seen really are minimal. We've had no deaths, no major morbidity. And I really am excited about this. I -- I think that we are on the threshold of something very big.

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JAMES LONGORIA, MD: I think one of the things that we have is an extremely, again, integrative and collaborative effort between electrophysiologists and surgeons, and I think that's one of the things, as Derek has found out, that we have to offer here versus other programs throughout the country. And you know, before we finish here, we do have a couple more questions. One, it says: are insurers and HMOs covering this? I almost died from GI bleeding due to coumadin and I want help.

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LARRY WOLFF, MD: I'd say that probably a fourth to a third of the patients that we have done so far at Sutter are in a managed care program. And I don't know that there has been any problem with reimbursement.

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JAMES LONGORIA, MD: I think one of the things we need to reiterate is that we're not doing anything experimental. What we're doing is the exact operation which was designed for a known disease process, and so I think we want to reassure our patients that that should not be an issue. The other question here, it says: if I had this procedure, could I discontinue my current medications?

01:02:19

LARRY WOLFF, MD: Well, it depends what medications they're taking. I mean, if they're taking medications for hypertension, no, that has to continue. If you're taking medication for atrial fibrillation and we are successful, I would assume that we could stop them. It is important to point out that when we do this procedure, we continue anticoagulant therapy for about three months just to make certain, as in Derek's case where there are a couple of short paroxysms of atrial fibrillation, that people don't have a clot that develops. So people do continue medications for several months.

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JAMES LONGORIA, MD: Great. Well, with that, I think we'll wrap it up. I'd like to thank my co-host, Dr. Larry Wolff. Derek, I'd like to thank you for coming all the way from Seattle to join us. And again, for those that are on the webcast, I think one of the things you can do is if you have further questions, you can submit them through the MDirectAccess button as well as there is information that we would be happy to send out to you if you would request. And again, I want to thank you both for joining us today and I look forward to future success in what we do.

01:03:26

LARRY WOLFF, MD: Thank you.

DEREK GALISHOTE: Thank you.

01:03:28

JAMES LONGORIA, MD: Thank you.

01:03:34

ANNOUNCER: This has been a totally thoracoscopic epicardial surgical ablation procedure for atrial fibrillation live from Sutter Health in Sacramento, California. 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.

01:04:03

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