

**OFF-PUMP CORONARY ARTERY BYPASS - A BEATING HEART PROCEDURE  
MERCY HOSPITAL  
MIAMI, FLORIDA  
October 4, 2007**

00:00:12

ANNOUNCER: Welcome to Mercy Hospital in Miami, Florida. Over the next hour, you'll see an off-pump coronary bypass. If one or more of the main blood vessels feeding the heart is blocked, doctors can reroute blood around clogged arteries. By taking a segment of a healthy blood vessel from another part of the body, they can make a detour around the blocked part of the coronary artery. This improves blood flow and oxygen to the heart. Traditionally, the heart is stopped during the procedure and life is maintained by a heart-lung machine. Now surgeons can operate as the heart continues beating while the bypass graft is sewn in place. Blood can use this new path to flow freely to the heart muscle. 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.

00:01:06

JOSE MARQUEZ, MD: Hello, everyone. Welcome to Mercy Hospital in Miami, Florida. I'd like to remind you that our webcast is being transmitted both in English and Spanish. I'm Dr. Jose Marquez. I'll be your moderator for the night. Tonight, you'll hear about the procedure known as off-pump coronary artery bypass surgery, which is a procedure that has helped a significant amount of patients to alleviate their symptoms of anginal coronary artery disease. You will be seeing the newer approach of the procedure as compared to the traditional approach of the patient going on the heart/lung machine. This is done without the heart/lung machine. Before I introduce the surgeon tonight, I'd like to remind you that you can e-mail us at any time during the next hour by clicking on the MDirect button on your screen. We'll try to answer all of your questions at the end of the procedure or throughout the procedure. Tonight we have with us Dr. Peter Segurola, the chief of cardiothoracic surgery at Mercy Hospital. Welcome to the -- to the program. Before I -- we get into the procedure itself, I'd like to have Dr. Segurola in about a minute or so give us the benefits of this type of approach to revascularization of the heart as compared to the traditional approach. Dr. Segurola, welcome.

00:02:35

ROMAULDO SEGUROLA, MD: Thank you very much, Dr. Marquez. I'm very excited to be here today and explain the nuances in myocardial revascularization for patients that have obstructive coronary artery disease. We have to look at this as avoiding risk factors. And the cardiopulmonary machine, or the bypass machine, although very effective, if we can perform the surgery without this machine, one can only imagine the risk factor that we have just eliminated. How does this translate clinically? Less neurological events. In other words, less stroke. Patients have chronic renal insufficiency, chronic renal problems. There will be less of an insult to the kidneys. Patients that have severe emphysema, severe obstructive pulmonary disease clearly benefit from this procedure. So what does this mean? We have a very

effective way to perform the surgery, and now we can offer it to patients that maybe otherwise would not be considered for coronary bypass revascularization.

00:03:35

JOSE MARQUEZ, MD: Very good. And I'd like to show you a clip of one of the patients that you've done, Mr. Patrick Rebull, before and after the surgery, what he had to say before we get into the surgery itself. So this is what Patrick had to say before the procedure.

00:03:55

PATRICK REBULL: -- concern prior to undertaking, to undergoing rather, this type of surgery, but certainly when you consider the -- the alternative, there's really no -- no decision involved. I mean, insofar as the off-pump surgery versus the -- the on-pump or using the cardiopulmonary pump, basically that was not a consideration on my part other than certainly understanding that being on the pump, it would involve stopping your heart for some period of time. That was certainly a consideration, whereas off-pump, the heart remains beating. That was a preference, if you will, that certainly helped me go forward with this particular procedure definitely. So that's for sure helped me in my decision.

00:05:01

JOSE MARQUEZ, MD: Very good. Peter.

00:05:05

ROMAULDO SEGUROLA, MD: Patrick was an excellent candidate. He had a very significant concern and he wanted to reduce his risk of stroke dramatically. And the true risk of stroke with this garden-variety, the standard coronary bypass revascularization could be anywhere between 2-6%, so he really -- this was a very important point for him. He really wanted to minimize this. And this is one of the things that is suggestive of off-pump surgery. There's clearly less trauma to the aorta, as you will see later in the clip, and therefore one could reduce this. In addition to this, when we also use, as technology advances, the use of proximal connectors, we further decrease the risk of any type of neurological event. Patrick did very, very well, and he recovered quite nicely. In five days, he was out of the hospital.

00:05:57

JOSE MARQUEZ, MD: Very good. That's another point that you -- that I mentioned at the beginning, the -- the -- we might be able to shorten the length of stay in these patients, transfusions, et cetera. We -- we do see a lot of patients that are easy to extubate right on the table, right after the surgery, you might be able to get them off the ventilator. And we see a lot of these people on the floor ambulating within 24 hours, so there's a lot of things that we will touch upon during the program, but I -- we at Mercy Hospital, as you know, we have been pushing our surgeons to perform the bypass surgery if, whenever you guys can, off-pump because of all the benefits that we truly believe that the patient will -- to the benefits of the patient. So why don't we go ahead and move on to the procedure itself so that we can discuss it at length. Peter, could you go ahead and take over?

00:07:08

ROMAULDO SEGUROLA, MD: This is our main operating room at Mercy Hospital, and we're going to go over several things during surgery. One of the things that we're doing is a combination of nuances. The combination is doing the procedure in an off-pump method using proximal connectors in order to avoid dramatically the risk of stroke and how we harvest the vessels. Like, for example, here, we're harvesting the radial artery. Now, this used to be done pretty much by opening up the whole forearm a good eight to ten inches. We do this now minimally invasive. We use one centimeter incisions, and as you can see here, we're actually tunneling down the leg, harvesting the saphenous vein. What you had seen before, we were tunneling a

radial artery. This is the vein. Before, as you can see this scope coming in, an incision would be made down this whole leg. Now no incision is made. Here, for example, you see the arm where we're harvesting an artery, and every time we can use arteries is far better than if we use veins. The longevity of these conduits are more, as long as they're ideal conduits. What you're seeing there, that we put a little clamp on the -- on the artery just to make sure that the hand will not be sacrificed by less blood supply to it. Here, what you're seeing is we're milking the blood out of the forearm in order to have a dry field as we then harvest the -- the conduit of the radial artery. Here we're -- we're introducing the tunneler, as you can clearly see, and it has a very bright light, and this will go circumferentially around the vessel. And -- and you'll be able to see it inside, how we cauterize all the branches. One of the things that I'm very excited about is the less trauma to these vessels when you do it in a minimally invasive fashion versus opening up the arm and then having a lot of neurological problems, and this is one of the reasons this was out of vogue for a very long time. Here we're directing our attention down the leg, which is the conduit used traditionally for bypass surgery, which is the saphenous vein. Here is the complete set-up of the team. We basically first harvest the blood vessels that we're going to use to reconstruct the artery supply to the heart and then followed by my part that you'll see in a brief period of time. This is the counter incision that we use to amputate, if you will, the most distal segment of the vein. As you can see, it's not even a centimeter. Imagine this being done before by having to open up the whole leg or having skip incisions down the leg. If there's one element that has clearly revolutionized bypass surgery, it's obtaining these vessels, especially in the diabetics, in a minimally invasive fashion. The risk of wound infection, which is a very, very serious risk, has been just about eliminated with this. As you can see here, we are removing now the vessel from the tunnel that was made. This is the artery, this is the radial artery. Next to the mammary artery, which you'll see pretty soon, this is what gives the longest patency rate. And as you can see, instead of having an incision up the whole arm, you're actually seeing an incision here that is just one centimeter.

00:10:42

JOSE MARQUEZ, MD: I'd like to add that with this newer approach of removing the veins or the arteries with minimally invasive, with small incisions, I remember 10, 15 years ago, when we -- all the vessels used to be removed with a completely open incision in the leg, patients used to complain more about the discomfort and pain in the legs than -- than the actual incision of the sternum. And with this approach, it's incredible how we have been able to eliminate a lot of those complaints and infections and complications of the lower extremities.

00:11:28

ROMAULDO SEGUROLA, MD: We really have to emphasize that point. That is a very well-taken point. The risk of an infection and the pain -- in fact, the pain down the leg is well stated, Dr. Marquez. It used to be worse than the sternal pain that these patients had. So as we can see, the radial artery has been harvested here, and so has the saphenous vein for the reconstruction of the heart. Here we're doing a standard medium sternotomy. The incision we're using nowadays is half the size of the old incisions that went down almost to the bellybutton. We're actually grooming here the incision to make sure we have pretty much a bloodless blood field or as much as we can. Very selective cauterization so we decrease the risk of sternal infection. And that is basically what you're seeing here. What we're trying to find here is a little plane under the sternum, and then using the sternal saw, one very gingerly will open it along the midline. This is another technique to further decrease the risk of infection. When you veer either to the right or to the left of the midline, that's one of the risk factors of sternal infections. As you see here, we undermine

now the more upper pole of the incision in order to give the patient a little bit better cosmesis instead of opening up an incision all the way up into the neck. Where the sternum has been opened here, and basically what we are doing, is just cauterizing and keeping everything tidy. Here, this is the most important vessel that we use for bypass. This is the internal mammary artery, and this is the way it looks, and I'm carefully dissecting it, exposing it, and this will be used to reconstruct. This is, of all the vessels that we can use, the one vessel that will give the patient the longest patency rate.

00:13:27

JOSE MARQUEZ, MD: That is something that we try to -- of course, this is standard in surgery today, of using the internal mammary, but whenever we can use also the right -- we have two mammary arteries, one on each side. Whenever we can use the right internal mammary artery, especially in patients -- younger patients who will live longer -- we try to do that. And of course, whenever we can use the radial artery for bypass, we'll do that. So we are moving also, we try to push our surgeons to do what we call -- what we call complete arterial revascularization, because we believe and it's been shown that the arteries are much better patency than the veins from the lower extremities. How many -- I'm sure there are patients watching the program tonight who have had bypass surgery 10, 12, 15 years ago and have come back with recurrence of angina, and the problem has been degeneration of the saphenous vein graft, where fortunately today we can fix it in the cath-lab with stents, et cetera. So this is something that we also push a lot our surgeons to do is to try to do complete arterial revascularization.

00:14:45

ROMAULDO SEGUROLA, MD: What we're seeing here is we've exposed the heart, and this is the sac that envelops the heart and protects the heart. It's called the pericardial sac, and we're opening up the pericardial sac in order to get to the heart. And these are all techniques that have been verified. You have to open up the sac in such a way that the heart can now fall into the right plural cavity. This is something not done in traditional bypass surgery, and these are the techniques that we've learned over the last 10 years, of how to then expose the heart while it is beating and not compromise the patient's blood pressure or the heart rate, which is the limitation of this effect. If you don't have the advanced training in these types of technique, then you try to manipulate the heart, the patient won't sustain it. What you're seeing here is that I'm manipulating very slowly, very gingerly the heart, and at the same time, I'm working closely with my anesthesiologist to see if the patient's blood pressure is maintained, if the patient's heart rate is maintained. And I'm looking for my targets. The heart is paralyzed if you're using the heart/lung machine. This is a very, very simple task. It is challenging. It requires quite a bit of expertise in order to do this effectively.

00:16:00

JOSE MARQUEZ, MD: I'd like to remind the audience that coronary arteries, the diameter of an artery is between approximately two to four, four and a half millimeters, millimeters. So imagine with all the -- all that motion and fat tissue that we see, et cetera, to localize the artery is really a very skillful maneuver here by the surgeon.

00:16:25

ROMAULDO SEGUROLA, MD: Now, right here, we're -- this is the arteries of the inferior aspect of the heart that we're looking at to see if we have any -- any targets that we can use here. And again, and through all these maneuvers, we're working very, very closely with the anesthesiologist, modifying the drips. Because since we don't have the heart/lung machine, it is up to pharmacological measures and appropriate exposure that we can actually expose the heart in order to do this

surgery when the heart is beating. As you can see, let me point out something very clear here. We're not really touching the heart. There's no trauma to the heart, there's no trauma to the blood vessels, so any particulate matter -- clots, plaques, and so forth -- they're not dislodged, and therefore this is what reduces the risk of a stroke.

00:17:15

JOSE MARQUEZ, MD: Though I'd like to mention, as you said before, probably the high, or the most important risk of a stroke is the manipulation of the aorta, which you will get into later on, I'm sure, in causing stroke. But again, as Dr. Segurola has mentioned, here with all that we are doing, there is no damage being done to the heart. Before you move on, I'd like to -- there are some questions coming in, I'd like to ask you a question. I have a question here, it says: what are the risks I may expect from having off-pump surgery as compared to the traditional? I guess we have to go back and say that the risks are the same, but they are reduced.

00:17:56

ROMAULDO SEGUROLA, MD: That is exactly -- that is exactly the point.

00:17:58

JOSE MARQUEZ, MD: We believe they are reduced.

00:17:59

ROMAULDO SEGUROLA, MD: The risks are reduced, the data clearly shows that there's a trend to decreased stroke, decrease the amount of blood supply that you might need, decreased ventilatory times, ICU stay in the hospital, and so forth.

00:18:16

JOSE MARQUEZ, MD: Right. Another question that came in -- I'm sorry to interrupt you because we have limited time: am I -- if I need bypass surgery, how do you know I will be a candidate for a harvesting of the veins endoscopically versus open? How do you assess that?

00:18:32

ROMAULDO SEGUROLA, MD: Well, everybody is a candidate for endoscopic harvesting. You might not be a candidate for an off-pump procedure, but this has to clearly be emphasized. Everybody should ask for endoscopic unless it's an emergency. Because this is -- the data here is very clear. Now there's no suggestions. Now we have clear data. The decrease in infection and pain is dramatic. And especially since the majority of our patients are diabetics and they have wound-healing issues, they should all be offered this.

00:19:05

JOSE MARQUEZ, MD: We'll go back to the surgery, please. Now I think here, you are preparing the --

00:19:15

ROMAULDO SEGUROLA, MD: We are preparing the LIMA -- the mammary, which is the internal mammary artery. I had exposed the heart, I know that we can perform this surgery now in an off-pump manner. As you can see by certain types of dissections that we don't routinely do during the typical or the standard bypass surgery, the heart is beating, and the area that I'm going to sew on is very well stabilized. As you can see, this particular patient, you'll see that the artery was a little bit intramyocardial. It's not very easily exposed. And this --

00:19:55

JOSE MARQUEZ, MD: Right, that's -- that's a good observation that we have to make. Usually the vessel runs on the outside of the muscle, but sometimes it is within the muscle, especially with this, the left anterior descending, so the surgeon has now to open up the muscle to find the artery, so it makes it a little bit more challenging but it's doable.

00:20:15

ROMAULDO SEGUROLA, MD: Exactly, and it's a matter of training and going through the learning curve. It's -- remember, unlike bypass surgery, what is attractive to many surgeons is that the heart is paralyzed and is a bloodless field. Here you have to get used to working with a beating structure, and it's not bloodless. You know, you have to deal with blood and you have to see around that. That that you're seeing right there is using a little bit of saline and you use a little bit of CO2 mist in order to expose the vessel as I'm bringing it out. This vessel here, for example, has several millimeters of fatty tissue over it, and that's very, very bloody. This is the LAV, which is -- we can even say the main artery in the interior aspect of the heart, which supplies the septum, that we are exposing in order for -- to bypass. You saw what happened there. Sometimes, and these are one of the things that happens with this type of surgery -- sometimes you have to stop and you have to reposition the heart and make sure that everything is fine. Sometimes the anesthesiologist will tell you, "my blood pressure is dropping." You have to be ready to stop the surgery, resuscitate briefly the patient, and then resume. This is something that is very dynamic, unlike standard bypass surgery, which that is why it is attractive to many surgeons, it's -- there's no stoppage, it's just go, go, go, and you finish the surgery.  
00:21:45

JOSE MARQUEZ, MD: In this case, as you mentioned, the anesthesiologist is a very important person in the operating room because here they are -- the anesthesiologist is the one that's telling you what's going on with the hemodynamics of the patient, the blood pressure, et cetera, so very, very important. And it's the one who manages the medication during the surgery, so that very, very important part of the puzzle.  
00:22:11

ROMAULDO SEGUROLA, MD: This is clearly a team effort. Unlike the other type of surgery, this -- every single person in that room is essential.  
00:22:18

JOSE MARQUEZ, MD: And as everyone can see, the heart is still pumping, doing the job of what the heart/lung machine would be doing. It's doing its normal thing. One of the things that you didn't touch upon is the -- the possible associated side effects of the heart/lung machine. Why don't you do that?  
00:22:37

ROMAULDO SEGUROLA, MD: The -- well, let's be practical about this. You're getting the -- all the blood content of the body and you're passing it through a machine that is going to function as a heart and is going to oxygenate the blood. What's going on here? If we're practical about it, it's very simple, you're making the blood now go through a -- another type of surface, it's not the natural surface.  
00:23:01

JOSE MARQUEZ, MD: Right, something that is not natural.  
00:23:02

ROMAULDO SEGUROLA, MD: And then that is going to invariably trigger off an intense inflammatory response. And then if we were all -- if we were all healthy, we wouldn't have heart disease. So these are -- people that have heart disease, they have kidney disease, they have lung disease, they have, you know, vascular brain disease and so forth. And when you create an intense inflammatory response, what happens is that all these other, you know, maybe dormant types of issues you have with other organs are going to become clinically relevant. And that's what we're trying to reduce with this.  
00:23:37

JOSE MARQUEZ, MD: Absolutely. Can you go back and describe what we're doing now, Peter?  
00:23:41

ROMAULDO SEGUROLA, MD: Okay, here, as you can see, I wanted to show this because this is one of the -- this is one of the concerns that many surgeons have, that if you don't have a very superficial vessel, this can't be done. And this vessel is intramyocardially, and what we have been doing here is very, very slowly just dissecting until we get to the vessel. It is painstaking. There's some time involved with it, but it can certainly be done. And we're getting to it. And it's a matter of exposing it. Right here, you see that it's -- I've exposed it. It's now bulging out through techniques that we use. Now I'm going to open up the vessel, and right now I'm going to open it up some more so I can put a shunt. Now, this is a crucial part when you're doing off-pump surgery. One has to be ready and have an anesthesiologist that's ready and a team that is ready that if this patient in this moment in time, the heart stops, you have two minutes to get on the heart/lung machine. And even though it's in the background and you don't see it, this is what's going on right now. And if a little bit of air goes down that artery, then it's just like a massive -- an acute massive infarct. I'm putting a shunt there because I've opened up the vessel and I do not have any blood supply going through it distally. I -- you know, in practicality, we're creating an infarct. So in a minute or so, the time it's going to take me to put in this shunt, what happens is that I reconstitute the blood supply, now allowing me all the time that I need to safely perform the anastomosis. And I've converted a bloody field now into a semi-bloodless field.

00:25:15

JOSE MARQUEZ, MD: Because the shunt is in place. You made a good point before. This is a painstaking procedure. I mean, you have to be patient. And one of the things that us, interventionalists or surgeons, sometimes on a patient, we want to finish the case rather quickly, and this is one of the things that I think keeps some of the surgeons who are very qualified in doing this kind of procedure from doing it, and it's the fact that it takes time. It takes a little longer time than the traditional surgery to do. But again, I think that the benefits really merit the effort.

00:25:54

ROMAULDO SEGUROLA, MD: The -- as you well know, everything -- the bottom line here is that everything has to do with patient selection. If you select the patient properly and you can perform the same surgery that you would on the pump off the pump, you've eliminated an amazing risk factor. But the key question is that you can do it equally as good off the pump.

00:26:13

JOSE MARQUEZ, MD: I have a question is: how -- who are the patients who benefit more from the heart surgery, from this type of surgery in general, who are they?

00:26:27

ROMAULDO SEGUROLA, MD: This is a very interesting question. It's a counterintuitive answer. The sicker you are, the more you benefit.

00:26:34

JOSE MARQUEZ, MD: Absolutely. That's the point that I wanted you to make. Absolutely. If you -- if you are older than 75 years of age, if you have had prior strokes, if your heart is weak to begin with, if you have renal dysfunction, et cetera, these are the patients that we have found who benefit most from the surgery.

00:26:54

ROMAULDO SEGUROLA, MD: And look how interesting this is. The heart is --

00:26:58

JOSE MARQUEZ, MD: And which are most of the patients that you are seeing today. We are -- we are fixing in the cath-lab the younger guys with easier anatomy, and you're getting the older, sicker patients in the O.R.

00:27:07

ROMAULDO SEGUROLA, MD: The average patient we have are in your 70s or 80s. Medications work very well, cardiologist is doing a fine job opening up blood vessels. So it's not like 20 years ago that we were operating on 60-year-olds. Add 20 years to this. What's very, very interesting, as you well mentioned, is that the sickest patients are the ones that benefit the most and at the same time, they are the hardest patients to perform the surgery. So that's why it takes an enormous amount of expertise and practice in fact to get the knowledge that you can actually afford.  
00:27:42

JOSE MARQUEZ, MD: Now that we are -- we are back on camera, can you go -- could you show us on this model heart that you have here in going back to the -- I'm always -- the most devastating thing that can happen when you go through an open-heart surgery is developing, acquiring a stroke. Could you go over that?  
00:28:06

ROMAULDO SEGUROLA, MD: Well, what you just saw in the video is the distal anastomosis that we performed, okay? We'll see now another anastomosis where we've had to do the proximal anastomosis. The worst thing that could happen to a patient is that you fixed her heart and then they'll never wake up again or if they wake up, half the body's paralyzed. That is a formidable complication, and I'll emphasize this in reference to this. As we see here, this is what a normal artery should -- should look like. And the disease is this yellowy substance here, is the fat that starts to accumulate. It's the fat that starts -- it's the fat that starts accumulating. If this is happening here in the coronary arteries in the heart -- look at the heart here for a second. Can we beam into the heart, the model, the heart model? If that is happening right here, it is also happening along here and every other blood vessel in the body. Even though we don't see it, it's there. And the least manipulation that we do there, the less likely the probability that we will dislodge one of these vessels. And how do we do this traditionally? This is a side-binding clamp. If you paralyze the heart, you have -- let's look at the model for a second. If you paralyze the heart, what happens is that somehow, through some mechanism, I have to avoid blood entering back into the heart. The only way that you can do this is to -- this is a cross clamp. I would have to clamp here like that, and it has a crushing effect. So you see it like that, it has a crushing effect. So any debris is going to be dislodged. At the end of the procedure, to buy me some time, I remove this, and then I have to do this. I have to use a side-binding clamp, as everybody can see it, and then I side-bind this in order to give me a little area to sew. So we have plaque here, and we have eliminated two more risk factors. This is something incredibly important.  
00:30:07

JOSE MARQUEZ, MD: Let's go back to the case and let's see if we could show now the -- the next portion of the surgery.  
00:30:19

ROMAULDO SEGUROLA, MD: So basically here, we've finished the anastomosis with the LIMA, and this is a security point. This is -- in the standard coronary artery bypass revascularization they use the pump, this is the last anastomosis that you do. In off-pump surgery, it is the first anastomosis that you do because now I have real-time blood flow going through here. Two-thirds of the blood supply to the heart has been restored right now.  
00:30:42

JOSE MARQUEZ, MD: Which is the -- will give you now the time to do the other bypasses.  
00:30:47

ROMAULDO SEGUROLA, MD: And if you can appreciate this to the trained eye, if you look at the right ventricle, which is what you clearly see there more, you can see

how much -- how it's contracting already much, much better. And you can see it right in front of your eyes. It's the most dramatic thing.

00:31:00

JOSE MARQUEZ, MD: Absolutely. You can see it, a more vigorous contraction there.

00:31:03

ROMAULDO SEGUROLA, MD: You know, and -- and these are just little hemostatic pads that we put in in order to avoid any minor type of blood loss and so forth. We're going to move on now as this progresses.

00:31:21

JOSE MARQUEZ, MD: How about blood transfusion? What -- is the incidence of blood transfusion reduced with this kind of procedure?

00:31:28

ROMAULDO SEGUROLA, MD: The average -- the average patient going through a pulmonary artery bypass on the pump, it's probably going to require one to two units of blood. With this type of procedure, we probably reduce the risk of that to maybe one, sometimes none if we're starting off with a hemoglobin of 13 or 14. This is something very important that I want to stress to everyone. Here, we're exposing the artery, and now I perform my anastomosis and through other type of technology that we use here, I'm going to check my flows. And I'm going to be sure that that artery and that anastomosis that I performed is a perfect anastomosis. And if not, it's going to have to be revised through whatever means, and that's what I was doing there. You'll see a representation of that much better. So we did the LAD here, and now I'm -- I put the heart back in its natural position, and what I'm allowing now is just for the heart to recover a little bit. And if you can see here, now it's receiving much more blood than it ever has, and you can see that it's contracting much more vigorously.

00:32:40

JOSE MARQUEZ, MD: You mentioned that you measure your flows. That's something that I'm not -- it's infrequent. We don't see that very often, but you do that in every case. Does it really make a difference that you -- the need to measure that the flows are -- are what you want them to be in order to make sure the patency of the bypass maintains?

00:33:09

ROMAULDO SEGUROLA, MD: You know, I think so. It's like everything, it's just one more data point that is available to you to make a decision. Is it the final decision? It's not. But clearly, if you have no flow or very compromised flow and you had a troubled anastomosis, then what is that telling you you have to try? There's something wrong, you have to correct it. What do we also do? We also have a real-time echocardiogram. Something is what my flow is telling me, and is that being represented in my echocardiogram?

00:33:41

JOSE MARQUEZ, MD: Right, the echocardiogram, we'll see -- will look at the contract-- filling of the heart, the function of the heart.

00:33:46

ROMAULDO SEGUROLA, MD: And if I see that, then what is that telling me? That I have to go back and revise my graft.

00:33:52

JOSE MARQUEZ, MD: You measuring flow here.

00:33:53

ROMAULDO SEGUROLA, MD: And this is -- this the way we measure the flow, and there's a machine that you'll see in a little while that tells me -- very important. It tells me how much blood is going through my vessel. Number two, it gives me the resistance coming out of the vessel, and that's a very important data point because if

the patient has very aggressive disease, one could even predict what grafts are going to go down eventually. In addition to that, it also gives me the filling time, which is what we call the diastolic filling. Again, is it an absolute number and we just rely on it? No, but it's another data point to help us make a universal decision.

00:34:28

JOSE MARQUEZ, MD: Very good. Another question that I -- came along is: would off-pump surgery reduce the risk of post-op atrial fibrillation?

00:34:40

ROMAULDO SEGUROLA, MD: There are studies to suggest that. In a normal sequence of cardiopulmonary bypass, you have to traumatize the atrium because you have to put a very large cannula to drain all the blood out of the body, so again, you've eliminated that risk factor. You have less trauma to that atrium. Therefore, you can, from a theoretical point of view accept that there's less trauma, you should have less a-fib. Is there clear data that there is? No, there's not. There's suggested data. But again, you have to analyze that it's all about trauma, and there's less trauma.

00:35:17

JOSE MARQUEZ, MD: Also, pericardium. All the information that is around the heart, you traumatize the pericardium just by opening it, et cetera, that will contribute to the atrial fibrillation, no question about that. Can we go back to the case and see if we can see the -- the proximal anastomosis?

00:35:43

ROMAULDO SEGUROLA, MD: So what we've -- what we've done here is sometimes these vessels are in spasms, and I purposefully wanted to show this to emphasize a point, okay? I was not happy with my initial flows, so then I put a vessel dilation agents, I have my echocardiogram, I repositioned the heart, and I put all these factors, so then I have therapeutic maneuvers that I do to make sure that I'm happy with it. Once I am, then I move to another one.

00:36:10

JOSE MARQUEZ, MD: No question about it. All the arteries in the body tend to do this kind of vessel constriction when they are manipulated. We see that on the coronary anatomy when we -- when we put wires in to do the angioplasties. And you give nitroglycerin, you see the size of the vessel changing tremendously. You're still checking the flow there, I presume, after giving the vessel dilatory agents.

00:36:38

ROMAULDO SEGUROLA, MD: There-- there's a couple of things that we did in this particular patient. Number one, we gave -- we gave some vessel dilatory agents. Number two, we modified the blood pressure. During all this time that I'm doing this, the heart is recuperating and working with my anesthesiologist, and he's telling me, "okay, you're ready now to do the next one."

00:36:57

JOSE MARQUEZ, MD: To do the next part.

00:36:58

ROMAULDO SEGUROLA, MD: Okay, and that's -- so I was emphasizing that until I was ready. Here what you're seeing is the radial artery. We -- and again, if -- the number one, if you will, target is -- or vessel would be the LIMA or the RIMA, followed by the radial artery in reference to patency rate. These are all the branches that I've tied off. This usually gives you a patency rate of like 12 years or so, so basically what I'm -- I'm just preparing right now. And this gentleman, which is very important, not only did he get an off-pump surgery, not only did he get minimally invasive vessel harvesting, he has complete arterial revascularization. And that's what we emphasized before. And what you also see is that we used proximal

connectors. So we're eliminating as many risk factors as possible. I wanted to show this vessel that we're going to bypass, which is very important.

00:37:57

JOSE MARQUEZ, MD: Here you are bypassing -- you --

00:38:01

ROMAULDO SEGUROLA, MD: Well, what happen-- what happens in this particular, we were exposing now the lateral -- the lateral, the OM vessels. His blood pressure dropped a little bit. So then the anesthesiologist tells me, "put the heart down, check your flows again." Again, emphasizing the -- the dynamic of this process. And as you well said, that's why these procedures are painstaking. They're very dynamic. When you paralyze the heart, it's just, you know, go, go, go, but here you have to be -- you have to accept constant change. What we had mentioned before earlier, one of the differences in this procedure is that you have to be able to dissect in such a way that you can now put the heart into the left plural cavity, and that's what I'm doing. If you do not do this effectively, then what happens is that you compromise the right atrium, the right ventricle, and that's when the patient crashes on you. So that's what we've really learned how to do this. The oppon-- the opponents of this type of procedure, one of the biggest issues they have is that they say that you cannot expose the OM vessels of the heart. All the heart -- this is -- the learning curve, the biggest component to the whole learning curve is this that I'm doing right now, is rotating the heart into the left plural cavity and exposing the OM vessels. As you can see, they're already in the real posterior aspect of the heart. This is where the real skill comes in, and that's where you have critics that say that you can't perform complete revascularization.

00:39:42

JOSE MARQUEZ, MD: As you know, there are centers in this country who do almost every case off-pump, and in -- in experienced surgical hands, you could do most cases and you can revascularize most of the vessels. It just takes, there is a learning curve and it takes time. I mean, if you're dealing with a patient who has a very diffuse disease and very small vessels, et cetera, maybe the traditional surgery would be better serve this patient. But in a patient who has large vessels, they're excellent targets, I think it's -- this is very doable.

00:40:21

ROMAULDO SEGUROLA, MD: Look what we're seeing here. This patient has significant hypertrophy, so he has a big heart. That already is concern of many surgeons if they're going to try this. Now, we've put the right ventricle into the right heart, and as you can see where I'm going to be sewing here, I'm going to be sewing the posterior aspect of the heart. And I'm preparing here the radial artery before the anastomosis. So -- and here I'm exposed, as you can see. In a paralyzed heart, that vessel will be right on top of the heart because I could rotate and collapse the heart, and it becomes -- you know, it becomes a cinch to sew. But now I have to sew in a hole. And I have to make sure that I can sew in that hole just as good as if the heart was paralyzed. And you're seeing here the preparation in order to do that. You can easily appreciate just how posterior that --

00:41:17

JOSE MARQUEZ, MD: It's completely the back of the heart or the lateral back of the heart.

00:41:24

ROMAULDO SEGUROLA, MD: Now, small -- small non-hypertrophied hearts, those are the simplest hearts to perform because you can manipulate them very well, but when you're dealing with significant hypertrophy, then that is where the problem comes. So what I'm doing here is I'm opening up the OM vessel, or obtuse marginal vessel, so as you can see, the angles are completely different, they're all different.

And sometimes here -- I'm trying to put in the shunt now -- because of the angle, sometimes you can't put in a shunt. And when you can't put in a shunt, you have to be ready to sew with blood. So they have to blow with the mist or blower, blow the blood away from the field, then at that moment in time, you put in one stitch, and then they blow some more, and you put in another stitch. Again, very, very dynamic process, painstaking process.

00:42:16

JOSE MARQUEZ, MD: And for the audience to understand, remember, as I said before, the size of the artery. We're talking about two, two and a half to three and a half, four millimeters in diameter, and here you are working on those vessels, connecting a radial artery to this and hoping or making sure you end up with a -- with an appropriate anastomosis, that you don't make it too tight, et cetera, so you don't compromise your flow.

00:42:45

ROMAULDO SEGUROLA, MD: So in this particular -- in this particular case, what happened was that because of the angle of the artery, we could not thread the shunt. So it's not a big deal if you know what you do, so now you have to be used to sew with a bloody field and make sure that it's right. And that's what we're doing here. You know, you don't waste too much time with it, you try and you move forward. And this is the radial artery that is being anastomosed now to the posterior aspect of the heart.

00:43:14

JOSE MARQUEZ, MD: So he ended up with two?

00:43:17

ROMAULDO SEGUROLA, MD: This gentleman ended up with -- with three. He ended up with the radial and then on the right side, he ended up with a vein graft.

00:43:26

JOSE MARQUEZ, MD: A vein graft.

00:43:27

ROMAULDO SEGUROLA, MD: The next represent-- and here you go, and you can see, you know, once you get this down pat, you see the whole of the artery there, the lumen, and it's ready to -- I mean, it's not perfectly motionless, but it's to the point and you can actually -- so you have to be able to manage very well the geometry of the needles. And since you can't rotate the heart and you can't rotate your wrist too much, it's all about how do you position the needle so you can get the right -- and here, you see how it's easily -- how it's easily coming together.

00:44:04

JOSE MARQUEZ, MD: When do you do the proximal connection first before you do this?

00:44:09

ROMAULDO SEGUROLA, MD: Those are style points. Some people do proximal connections and then they do the distal connectors, some people do it the other way around. Those are just -- those are just basically style points when it comes to that.

00:44:19

JOSE MARQUEZ, MD: Does it depend on the patient anatomy?

00:44:22

ROMAULDO SEGUROLA, MD: It become --

00:44:23

JOSE MARQUEZ, MD: A totally occluded right and significant -- or totally occluded AD and a significant right or...

00:44:30

ROMAULDO SEGUROLA, MD: No, you can -- yes. If we're going to look at it from that point of view, anatomy would make sense to do it that way because if -- if you've

anastomosed the proximal, as soon as you do the distal, you're reconstituting blood flow.

00:44:43

JOSE MARQUEZ, MD: You're finished here with the --

00:44:44

ROMAULDO SEGUROLA, MD: So I finished with the -- and let's emphasize this for the viewer. There's not one artery of the heart that you cannot perform this anastomosis. Okay, this is just a matter of knowing how to do it. So I did my distal anastomosis, I'm now accommodating the artery the way it will lie, and now I'm going to perform my proximal anastomosis. And again, this is where we talked about the side-binding clamp.

00:45:17

JOSE MARQUEZ, MD: Before you get this, there's quickly a question pertaining to what you just did. The question says: is there a stabilizing device that is being placed on the heart that limits the motion of the beating heart? Of course, you did that.

00:45:30

ROMAULDO SEGUROLA, MD: It's the fork-like instrument that we use. The suction device --

00:45:34

JOSE MARQUEZ, MD: The suction device.

00:45:35

ROMAULDO SEGUROLA, MD: -- positions the heart. The stabilizing device is the fork-type of device that gives me a centimeter field of semi-motionless field that I could then perform my anastomosis.

00:45:48

JOSE MARQUEZ, MD: Could we go back to the proximal connectors now on the tape?

00:45:58

ROMAULDO SEGUROLA, MD: This is something that I'm very, very excited about. The opponents of off-pump surgery would tell you that you've gone through this whole complicated --

00:46:10

JOSE MARQUEZ, MD: Yeah, this is important. I'm sorry to interrupt you. What you're doing now is preparing the aorta?

00:46:15

ROMAULDO SEGUROLA, MD: I am preparing the aorta.

00:46:17

JOSE MARQUEZ, MD: To connect the --

00:46:18

ROMAULDO SEGUROLA, MD: The proximal connection.

00:46:19

JOSE MARQUEZ, MD: The proximal portion of the bypass with a special device called a proximal...

00:46:24

ROMAULDO SEGUROLA, MD: Well, there -- they're not really connectors, they're proximal assistors, okay? And basically -- you see, this is the emphasis. You see that side-binding clamp? I would have to put it there, and it'll crush whatever is inside. And that's where you have the stroke.

00:46:39

JOSE MARQUEZ, MD: Right. If you were to do it without this assist device.

00:46:41

ROMAULDO SEGUROLA, MD: Right. Because --

00:46:42

JOSE MARQUEZ, MD: And that in itself, though, you do not -- you are not cross-clamping the entire aorta, you are cross-clamping part of the aorta, and you can dislodge a plaque and cause a stroke.

00:46:53

ROMAULDO SEGUROLA, MD: Yeah, if you compare -- and data is clear on this -- a cross-clamp with a side-binding clamp, the side-binding clamp is far worse in reference to the risk of stroke. So as you can see this, I've made a hole in the aorta, and now I'm deploying the device, and it's a bloody field, okay? It's basically like an umbrella that is now there, and it creates the hole. Now I have to accept blood, and then with my blower what happens is that they -- the blood is just being dispersed around. And look how the heart's beating already, you see. I mean, it's just dramatic right in front of your eyes. So that that you see there like that, a pyramid shape, those are the stabilizers. That's my radial artery, and basically what I'm doing there is I'm performing the proximal anastomosis. And you'll see it more clearly here. And that would then reconstitute blood to the lateral aspect of the heart. And that's where the skill comes in, and you know, it's bloody, it's moving, and you just have to get it done.

00:48:02

JOSE MARQUEZ, MD: Yeah, absolutely. But again, the -- we believe that if you're going to have bypass surgery and your surgery can be performed this way, this is what we suggest to our patients to have it done this way.

00:48:21

ROMAULDO SEGUROLA, MD: You know, if -- if we look at it, if you can perform the same surgery and you eliminated all these risk factors that we talked about -- side-binding clamp, a cross-clamp, a bypass machine paralyzing the heart -- it's intuitive. You know, you're eliminating risk factors. That's something that you discussed earlier which we should emphasize. Hearts that are very sick, when you paralyze them and then you have to restart them, you get into trouble, you know? And this is a way that you can just reconstitute the blood supply without, you know, paralyzing the heart.

00:48:58

JOSE MARQUEZ, MD: Though the heart is protected with certain specific solutions, we do see the heart coming out weaker. It might take -- it might take sometimes it takes -- it takes time for the heart to recuperate, and in the meantime, the first few days, the heart could be so weak that the complications of -- other complications like renal failure, et cetera, will just be more accentuated, absolutely. I think that whenever you go this way, this is the way to -- the way to go.

00:49:30

ROMAULDO SEGUROLA, MD: So this -- this is the proximal anastomosis that we're performing here, and basically I'm just looking for little bleeders that I'm just grooming them right now.

00:49:42

JOSE MARQUEZ, MD: Right. And so since we have about 10 minutes left I think on the program, I want to ask you a few questions that have come in for the --

00:49:49

ROMAULDO SEGUROLA, MD: Let me just emphasize this. This is a graph of my flow probe analysis, and that vessel right there -- anything above 15 is excellent -- I have 39 millimeters per minute flowing. My PI, which is -- represents my outflow, the resistance less than five, which is exceptional. Red is the blood going in and the diastolic filling is blue. And my diastolic filling is 77, that is an exceptional graft.

00:50:12

JOSE MARQUEZ, MD: Right, the coronary arteries of the heart fill in diastole, and that's what we're looking at there. A few questions have come in: how long should I expect to be in the hospital after this surgery as compared to the traditional surgery?  
00:50:27

ROMAULDO SEGUROLA, MD: As compared to a traditional surgery, it's basically five days. Compared to a traditional surgery is seven to eight days. Okay.

00:50:35

JOSE MARQUEZ, MD: How long before I start my rehab program?

00:50:42

ROMAULDO SEGUROLA, MD: You would go home, okay, and then the cardiac rehab program starts basically at the second week after surgery, after your home health agency discharges you from their care. Then we have an out-patient cardiac rehab that we monitor you very carefully as you start becoming more physically active. When do you resume your average-day living is between four weeks. No limitations whatsoever, in general, we're talking about two to three months.

00:51:08

JOSE MARQUEZ, MD: Very good. I think we have a follow-up to the introduction by Patrick Rebull, and I would like to hear him. Okay. So as we wait for Patrick's response -- okay, I think we have it, we'd like to see his response.

00:51:38

PATRICK REBULL: Before the operation, I -- typically I would feel sluggish, oftentimes out of breath, principally when exerting myself. As an example, running through an airport, trying to catch a flight. And I would attribute that to your basically being out of shape, overweight, so I really didn't pay that much attention to that condition. Certainly post-surgery, that has changed entirely. I'm no longer out of breath, I exercise on a regular basis, my friends, my wife all tell me that my whole skin tone and color has changed drastically. So veritably, there has been a change not just in my physical well being, sense of well being, but also psychologically. Prior to the surgery, I felt sort of sluggish and never had the ambition, really, to exercise, and now it's quite the contrary. I feel very active and I get up early in the mornings, whereas before it was obviously very difficult for me. And so basically my lifestyle's changed tremendously since the surgery.

00:53:14

JOSE MARQUEZ, MD: Very good. I think it is important, what he said. He said -- he never mentioned that he had chest pains. He mentions, "I had no energy, very short of breath," and that's important. That's important because probably half of the individuals who have significant coronary artery disease, the symptoms do not manifest with the typical -- you would think of that crushing chest pain with effort, et cetera. It just presents in -- in Patrick with a lack of energy, shortness of breath, and all that went away -- all that was a cause of lack of oxygen to his heart muscle, and that all resolved with surgery. So it's very important to keep that in mind that it's just not that pain that -- that should make you think that you have a coronary artery disease. There's many ways of presenting, and as you see, just shortness of breath and lack of energy was his presentation. Let me see if I have -- I have one more question. This is more of a medical question. I think we still have a few minutes left. It says: I just had a five-bypass surgery. Is there any way to remove the plaque that accumulates against the arterial wall? If so, I have -- if the artery is 60% blocked, there is nothing that can be done to remove the plaque? The question is: if so, what is the process. Well, if you have probably a 60% blockage, you do not need anything to be done. Usually that can be treated -- as far as revascularization is concerned. What you do is modify your risk factors. There are studies that show that plaques can regress with proper medical therapy. And hope -- and if it doesn't progress, that's what you -- what you want to do, the plaque stays at 60 or regresses with

proper medical management. Is there anything else, Dr. Segurola, you would like to add before we end the program?

00:55:13

ROMAULDO SEGUROLA, MD: I would like to add that it's very, very important behavior modifications, which is the ABCs: an active exercise program that has been first cleared by your cardiologist, reduction -- a complete reduction of fats in your diet, use agents, medications that are intended to control the fats that are usually metabolized or produced by your liver, and if you're diabetic, strict glucose control. And if you're a smoker, absolutely you have to stop smoking. That's like putting Elmer's glue into your bloodstream. That is clearly, clearly -- we have to emphasize some prevention before we consider any type of intervention.

00:55:56

JOSE MARQUEZ, MD: Absolutely. Risk factor modifications are the most important. So with this, I think that we've come to the end of our program. I'd like to thank the audience for joining us today at Mercy Hospital in Miami, and we hope to see you again in the future with another program such as this. Good evening. Thank you, Dr. Segurola.

00:56:27

ANNOUNCER: This has been an off-pump coronary bypass performed from Mercy Hospital in Miami, Florida. 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.

00:56:56

[ end of webcast ]