MARIO CASTILLO-SANG: Good afternoon to everybody. Thank you for joining us. On behalf of the panelists, we want to welcome you to the first round table webinar on MVR options for the younger adult. The format will be one of roundtable discussion, and it will be case-based. Our goals are to review the European and American guidelines on mechanical valve replacement, display the application of these guidelines throughout case-based discussions, to simplify the preoperative decision-making discussions mitral valve experts have with their patients prior to surgery, and to provide technical best practices and problem-solving techniques by mitral valve experts. Finally, to discuss the different alternatives in mitral valve replacement surgery for the young patient.

Today, I'm very pleased and honored to have with us a panel of friends. Dr. Tom Nguyen. Dr. Tom Nguyen specializes in minimally-invasive mitral valve surgery, and he is chief of adult cardiac surgery and a Helen Charles Schwab Distinguished Professor of Surgery in the Department of Surgery at the University of California in San Francisco. Dr. Robert Smith is a cardiothoracic surgeon who specializes in complex robotic mitral valve surgery at Baylor Scott & White in the heart hospital in Plano, Texas. Dr. Zajarias is the director of Structural Heart Fellowship and Professor of Medicine in the John T. Milliken Department of Medicine, Cardiovascular Division, at the Washington University in St. Louis.

And I'm Mario Castillo-Sang, a heart surgeon in Edgewood, Kentucky at Saint Elizabeth Health Care. Thank you all for joining us today, to the panelists. So these are our disclosures. Let's dive in.

We're going to talk today about guidelines-- both the American and European guidelines. And first, we'll start with a newly-published 2020 AHA/ACC guidelines for valvular disease as it pertains to the management of the patient who requires a mitral valve replacement. What has changed in these guidelines this year was the incorporation or the change in the age cutoff for the patient who requires the mitral valve replacement, provided they're a candidate for oral anticoagulation with Coumadin. This age cutoff changed from 50 years old, since 2017, to 65 years or younger. And so that carries a 2A indication in both of the guidelines, 2017 and 2020.

In the European guidelines, very similar to what we have seen in the new American guidelines. The age cutoff had been already, since 2017, for patients less than 65 years old who were good candidates for replacement to undergo a mechanical valve implantation. Patients who did meet this criteria were given that option. For patients who were 65 to 70 years old, that area was a discussion based on the European guidelines, a joint discussion with the care team.

So without further delay, this is the new algorithm or route that we will take to treat patients based on both guidelines. They're now coalescing to one thought process, where if the patient is a candidate to undergo or to have Coumadin therapy without contraindications, and the patient has a need of a replacement if a repair has failed or is a replacement from the get-go, those who are less than 65 years old become candidates for mechanical mitral valve replacement. And today, we're going to talk about three different cases. And we'll get, from our panelists, how those patients are managed, what the conversation looks like, and we'll get some pearls from them to intraoperative.

So our case discussions-- we'll present an echo. We'll have the panelists discuss the findings. We'll have some polling questions. And then, we'll have a nice conversation about the case.

This is the first case. So the first case is a 40-year-old otherwise healthy female with a history of rheumatic heart disease. BMI of 35 and a BSA of 1.8. She has dyspnea on exertion with short walks and one flight of stairs. Her left heart catheterization was normal. And her echocardiogram will be shown next. Dr. Zajarias?

ALAN ZAJARIAS: Thank you, Mario. So this is a transfer dual echo. And we have a long axis view of our chamber view. Well, you can see a dense amount of smoke in the left atrium and evidence of left atrium enlargement. You have a calcification of the mitral valve involving both leaflets with cords in the posterior leaflet that are retracted and calcified. So this is consistent with significant mitral stenosis.

MARIO CASTILLO-SANG: OK, why don't we have the polling question? As a reminder, this is a 40-year-old female with rheumatic stenosis. OK, why don't we go ahead and-- Dr. Smith, what are your thoughts on this echo, just looking at this echo?

ROBERT SMITH: So we've got a really nice summary of what's seen there. To me, when I look at this mitral valve, I think the biggest part of this is looks like a pretty classic rheumatic valve. And when you look at a classic rheumatic valve like this in a 40-year-old, you need to start thinking, is this a replacement valve? Or is this patient have a desire to have children, and so what kind of replacement? Is she still in childbearing age? Is she willing to take birth control pills? The other part-- and this is where the heart team is always a big piece of the discussion here is, is this a valve that is potentially intervenable through balloon mitral valvuloplasty.

And so based on the discussion points that were brought up about this valve, it doesn't look to be a good candidate, despite the fact that it doesn't have any significant regurgitation, which would be one of the things. There's calcium in the leaflet tips, extreme fibrosis down at the tips of the leaflet going into the papillary head. So those would be characteristics where you think that a balloon valvuloplasty might not do very well. But it's still a discussion point, you should have as a team.

And then, the other big point here is that you've got good right ventricular function, which I think is important, but a gigantic dilated left atrium with smoke already. So my guess is, this patient's already on anticoagulation. And so more than likely, we're going to be having a discussion about, hey, we want to do a valve for you that's going to try to put you in the best chance for a good long-term scenario without another operation. And so in my case, in my thoughts, I would be looking at directing this patient through active discussion towards mechanical valves.

MARIO CASTILLO-SANG: Tom, anything you want to add to that conversation? And perhaps touch on your approach to this?

TOM NGUYEN: Absolutely. Thank you, Mario. And thank you, everybody for joining. I want to expand upon a little bit what Rob said before, and what you said about the ability for anticoagulation in that decision-making tree.

If you ask people whether or not they want to be on Coumadin, most people will say no, who wants to be on Coumadin their entire life? But if you explore a little deeply, and you have a conversation with them, most are actually fairly amenable to being on Coumadin. So I know that in that decision tree, whether or not they can be on Coumadin, I think a lot of it involves a very in-depth conversation. And I think now, with in-home testing, it's not as bad as people think.

The only thing that-- I agree with Rob on all fronts. This patient should probably get a mechanical valve. One thing I would do, in addition to workup, any time I see a patient with mitral stenosis-- and in general I'm actually fairly minimalist in ordering labs or tests or whatnot. If I see a patient with a patient with mitral stenosis, I'll often get a CT scan. I usually don't get CT scans for everyone else. And the reason why I get a CT scan is because I want to see if there's a lot of calcium on the leaflets and calcium on the annulus.

And if it does, then it might change my approach a little bit. But also, it gives me an idea really how long I should book this case for. If it's going to be like this, it doesn't look like there's a whole lot of calcium in the leaflets, it'll be a relatively quick and easy case. If I see a lot of calcium on the leaflets and on the annulus, then I might require some debridement and patch reconstruction or maybe other creative stuff like TAVR and MAC, et cetera, et cetera, then it's going to be a longer day. So I always get a CT scan when looking at a patient with mitral stenosis.

But in this particular patient, I'll get a mechanical-- I'll steer the patient towards mechanical mitral valve replacement, give them to resources that being on Coumadin is not the end of the world. and a lot of people do it, and they have very productive lives. And I would approach this, hands-down, minimally invasive approach to the right chest.

MARIO CASTILLO-SANG: Alan, let me ask you this. [INAUDIBLE] what is your conversation like with a patient when you see them? Are you prepping them for that conversation with the surgeon too?

ALAN ZAJARIAS: I think in this case, Mario, the conversation has to be had early and it has to be repeated multiple times. Nobody gets excited about heart surgery, as everybody is pretty much has experienced. But I think patients need to understand that the rheumatic valve stenosis that this patient presents with is associated with a high risk of thrombosis, is associated with a certain amount of complications. And since she's a young individual, we want to make sure we do a lifelong management as opposed to a shorter term treatment strategy.

I agree 100% with Rob what he had mentioned about the candidacy for a mitral valvuloplasty, which in younger individuals, with the anatomy being appropriate, would be the first treatment. However, this valve is very degenerated, and the Wilkins score is way above 8. So as a result, we do want to encourage the patient to understand that they will get the open heart surgery, they will get a mechanical mitral valve unless there is a front contraindication to oral anticoagulation. And people tend to understand that the more they hear it and the more they learn about the safety profile of Coumadin or how to manage an active lifestyle with a good dietary habits, I think they will take it very, very well.

MARIO CASTILLO-SANG: Yeah, I agree. I think these are very, very good points. Looking at the polling questions, we had-- the first question was, how do you approach this? And I think, Tom, you already said that you would approach it through the right chest. Some of the audience, some in the audience commented they would do an open operation. Rob, what would you do? What would be your approach for this Operation

ROBERT SMITH: So for this, I think Tom's approach, right chest, would be very appropriate. I would either do it right chest or robotically, just depending on how the anatomy struck me for the best safety profile. But I think both of those are very appropriate approaches. I think an open surgical approach is also very good as well. And I don't think you're wrong in doing that at all.

I think the nice thing about this particular case, we don't have all the echo images, but we were really dealing with isolated mitral valve pathology here. And so it really sets up nicely, particularly even for the beginner in the minimally-invasive space. This is a really good case that sets up nicely for doing a minimally-invasive--

MARIO CASTILLO-SANG: Straightforward replacement, yeah.

ROBERT SMITH: But if you know you're going in to do a replacement, particularly if you're going to do a mechanical valve, you kind of get your stitches down right, you make sure you clear the pathology of the way of the leaflets. And this should set up pretty nicely for a straightforward mitral valve replacement.

MARIO CASTILLO-SANG: Perfect.

TOM NGUYEN: I just had a question--

MARIO CASTILLO-SANG: So--

TOM NGUYEN: --for Mario. Mario, question--

MARIO CASTILLO-SANG: Yeah, go ahead.

TOM NGUYEN: So Rob noted that the atrium is extremely-- the left atrium is extremely dilated. A lot of smoke in left atrium. What would you do? And would you ligate the left atrial-- or what would you do about the left atrial appendage in this scenario? Granted, the patient's 40, doesn't look like she has afib, but there's a lot of smoke in there and it's dilated.

MARIO CASTILLO-SANG: Yeah, I think in my hands, I definitely would have a left atrial appendage ligation. I've not been able to do what [INAUDIBLE] does with a V clip, so it would be a sutured ligation internally, for sure. Rob, what's your approach to-- do you like it all atrial appendages when you do a mitral valve operation, or do you, Tom?

ROBERT SMITH: I don't. I try to be pretty thoughtful about each of them. And this patient, let's assume she's not had atrial fibrillation. She's going to be on a pretty hefty dose of anticoagulation as it is. And while generally, ligating the atrial appendage or putting a device on it is relatively low-risk, it's not zero risk. And so I'm just trying to think of, what are the most effective ways to help treat this patient. And for me, it's making sure we really address that mitral pathology.

And then, I think, in different risk categories for thrombosis, I think, we can consider doing some in appendage. But that, for me, anyways, it dropped significantly when you start talking about the anticoagulation you're going to be on when you're already going to be using the--

MARIO CASTILLO-SANG: With a mechanical valve.

ROBERT SMITH: Correct.

MARIO CASTILLO-SANG: So here are some of the intraoperative findings. And so in this circumstance, you can see the severity of the disease process. Really, really an ugly valve. What are your thoughts right now, Tom, when you're seeing this, you're faced with this?

TOM NGUYEN: So it's a pretty diseased valve. What I also see are the papillary muscles are fairly thickened and diseased as well. And obviously, the lipids need to go. I'm going to replace the valve. I'm going to try to reserve as much chordes as possible. So I actually try not to [INAUDIBLE] too much. And I'll preserve it and I'll try to reanchor, resuspend the chordae, usually at the 10 to 7 o'clock position and then to the 4 o'clock position.

What I also-- obviously, you want to put the largest valve possible. But a pearl that many folks may or may not know is, the onyx valve-- and a lot of mechanical valves, you actually can spin the way it opens, as you can see here. You'll implant a certain way, but a couple of times in the past, I'll implant it, I'll look at it, and as the leaflets open, as those disk open, I'll hit against the [INAUDIBLE] muscle and I'm thinking, well, crap. I don't want it to get stuck there.

So sometimes-- not sometimes, you can definitely do it any time. But sometimes it's worthwhile to spin it to make sure it opens in such a way so it doesn't hit underlying structures. Because it's a mechanical valve, you don't have to worry about that left ventricular output track obstruction at all, so you can do that relatively aggressively.

MARIO CASTILLO-SANG: Well--

TOM NGUYEN: One thing I would be cautious about is how much you're really cutting into the papillary muscle. And I do think that the more you cut into the papillary muscle and the more you debris that posterior annulus, you do run the risk of AV dissociate--

MARIO CASTILLO-SANG: A degree of disruption, right?

TOM NGUYEN: Right. So I'm a little more concerned about that in this setting. Rob, any thoughts on that?

ROBERT SMITH: Yeah, well, I mean, I think couple things. So number one is-- and you saw it as you were cutting into the valve and starting to expose the [INAUDIBLE] apparatus. This is why when we talk about the Wilkins score and the amount of fibrosis that's there, this is a patient that's going to be pretty high risk for a leaflet tear if we were to do a balloon valvuloplasty. So when-- again, I really emphasize the heart team approach so that cardiologists and cardiac surgeons, even with balloon valvuloplasty can talk about these kind of different pathologies because rheumatic valve disease is not all the same, and this really highlights that. Because these are-- there will be times where there's a high-risk patient, they need to undergo a balloon valvuloplasty attempt but surgery needs to be on standby for some of those, because they can get really wicked-- [INAUDIBLE] there.

[INAUDIBLE] Tom was saying, I mean, largely, yeah, I agree. I try to preserve the papillary muscle function and preserving the geometry of the heart. So I usually use a [INAUDIBLE] gortex through the papillary tips and bring those out in a way to try to put them out to the side so that's usually 3-9, 10-4. If you look at the way the On-X valve is designed, it's actually got the bigger piece of the flange that goes down in that subvalvular space. And so that helps protect that out of the way.

The other thing I generally do is I usually put it in the anti-anatomic position, not--

MARIO CASTILLO-SANG: Very important point, yes.

ROBERT SMITH: And then I always-- the way I do it is I do the sutures and the atrial in the ventricular fashion. And I always make sure I have a mirror that I can look back up to the outflow tract. And this is even port access, this is robotic. I'll have my bedside assistant put a mirror in there just to make sure that I'm really aligning that with the outflow tract because the skinniest part of the device is along the lines of the outflow tract. If you can line that up right, you've got the biggest area, now, for your outflow track.

And there are opportunities to create some stenosis and folks when you're doing mitral valve replacement. Not as much as in the rheumatic valve, although they sometimes will have a very small ventricular cavity. But you still can cause alpha tract obstruction. Not profound, but an increased gradient there. So it's something you want to be watchful for. So try to line those things up the best you can and make sure you didn't grab any-- since you're everting those sutures, make sure you didn't grab anywhere directly next to the aortic valve vein, as you're doing that you may induce AI.

MARIO CASTILLO-SANG: Yeah, agree. I second all of those points. great points. One of the things I don't tend to-- I don't use a mirror, but I do use a very long endo right angle and probe the limits of the LVLT to make sure that my suture placement is going to correspond with that in the valve to [INAUDIBLE] atomic or two. These are great points. I also want to bring up-- one of the things that I prefer in the valve is the cage that protects the mechanism of the leaflets. So that's one of the things that we've all done surgeries to explant valves that are frozen, have panus growth on them. And that's one of the things that I fear. I don't want to do two operations in the same patient. And so that's one of the things that I look for in a valve that has a little more protection of the mechanism when you implant it.

TOM NGUYEN: Can I add something? Implantation a little bit as well. One trick I do-- I'm not sure if Rob and I know Mario, you do a lot of minimally-invasive. I take the valve-- whether it be a ring, mechanical, or tissue valve-- I take it off the handle pretty early. Now, I have it on the handle to put the sutures through. But when I'm advancing through, I take it off pretty quickly because a lot of times, the incision is tiny, you have to put it somewhat sideways--

MARIO CASTILLO-SANG: It doesn't fit.

TOM NGUYEN: But you really need to seesaw it back and forth to rig it [INAUDIBLE] the annulus. And the only way to do it is take off the handle because the handle restricts that. When I do my knot tying or core knot, it's like a tire. So I usually do it at the 1 o'clock position first and then the 10 o'clock position, the 6 o'clock position to really anchor it. And then I go around the circle to make sure it's nicely anchored. Yeah, I think it's really helpful. And we're not talking about aortic cases now, but same thing for a lot of minimally-invasive or even open aortic case. I take off the handle pretty quickly. Again, to really get it to seesaw and get it deep down and see it pretty well.

MARIO CASTILLO-SANG: Yeah, and I think you brought up a point that-- do remember that you can actually spin the orientation of the leaflets once it's implanted to-- which comes in handy if you don't like exactly the way it's seated. That's an important factor. But I think this was a great case of this cause and touch upon the different aspects of a rheumatic patient, a young rheumatic patient. I think we're going to move on to the next case.

The second case is a 55-year-old, otherwise healthy male with a history of moderate mitral regurgitation in the past. Has worsened and he's now with increased dyspnea over the last two months. He has a BMI of 27, BSA of 2. And his coronaries are clean, no disease there. And we're about to show you the TEE of his disease process. So this is his echo. Alan, what do you think?

ALAN ZAJARIAS: I can see why he has mitral regurgitation. This is definitely a valve with degenertive mitral valve disease. This is probably Barlow's. There's bileaf that prolapse and there's a flail component of the posterior leaflet. The flail gap is very large. You also see, potentially, some of the anterior leaves that also begins to look upward. So potentially, at least one chord if not two have broken. There is evidence of left ventricle enlargement, at least in this long axis view that you see on the right of the screen. And the left atrium appears to be enlarged as well.

So classic of degenerative mitral valve disease. He's clearly symptomatic because of the MR, and definitely would meet criteria for a surgical procedure.

MARIO CASTILLO-SANG: So-- [INAUDIBLE]. Go ahead, Tom. Go ahead, Tom.

TOM NGUYEN: What would you estimate is his EF at, Allen, just based off that echo? I think with this echo, I would say potentially low 50s to maybe high 40s. Now, the image on the left is a little foreshortened, and we're not really seeing the true long axis view. But I think within 45% to 50%, I would say.

MARIO CASTILLO-SANG: So when you see this patient and you see this echo, and obviously the patient is symptomatic, and-- I mean, you know the complexity of the pathology. And not all valves can be fixed or will be fixed, and that's the reality of things. What are you telling the patient, Alan, as a cardiologist? When you're referring to a surgeon?

ALAN ZAJARIAS: So I tend to get a transesophageal echocardiogram on every patient that I'm considering for mitral valve surgery, even before I refer to the surgeon. I think sometimes not knowing what the pathology looks like ahead of time puts the patient at a disadvantage, and doesn't give the surgeon the tools that he or she needs to actually have an appropriate discussion of, is this valve repairable or is this valve a non-repairable. And having that TEE is very, very important.

In this case, I think there is a very complex mitral pathology. You have redundancy of both leaflets. You have at least one if not the two chords that are torn. So I think up front I would say that I would like the patient to be seen by a highly experienced surgeon who specializes in mitral valve processes because they would have a higher rate of repair. But I would not be surprised if by any chance this is not something that is successful. I try to preempt the conversation that way, but I would try to emphasize that we would like to do a repair strategy first, if possible.

MARIO CASTILLO-SANG: Yeah, fantastic. And why don't we cue the questions, the polling questions, to see what the audience thinks of this. And then we'll go back to the discussion. Those are very good points, Alan. Tom, do you always get a TEE, or do you always request a TEE? How about you, Robert?

TOM NGUYEN: I don't. I guess the images here seem pretty reasonable. And I know that either way, the patient's bought himself or herself a trip to the operating room for a couple of reasons. One, they are symptomatic even though they have moderate MR. They do have a dilated left atrium, they do have decreased LV function, as Alan noted. So I'll be able to get TE in the OR and make my fine-tuning and game time decision there.

If I don't have a good TT image, then sometimes I'll get a TEE. Or if it's a horrible image. But if I know that the patient's headed to the OR and it's just a matter of making the decision on the line, then I'll just rely on the TEE in the OR.

MARIO CASTILLO-SANG: How about you, Robert?

ROBERT SMITH: So for me, I tend to have a pretty low threshold for getting a TEE for a number of reasons. Number one is, so many times in something like this-- again, this is complex leaflet pathology on top of which you have somewhat of a depressed LV. And you want to see that from as many angles as possible. You want to see what the sphericity of the ventricle looks like and planning what you need to do.

And so for me, again, low threshold for getting a TEE if it's very straight up P2 foil disease, I very well may not because a TEE is not without potential risk. You have a patient, you're giving them anesthesia, you're giving them drugs. And so it's-- their airway's at risk during that procedure. Although it's incredibly rare to have a problem. But it's not zero. So I'm pretty thoughtful with that. But in general, I think anything that looks beyond a straight up pathology I'll get a TEE for.

MARIO CASTILLO-SANG: OK. So--

[INAUDIBLE]

--I find-- uh-huh, go ahead?

TOM NGUYEN: Recently-- and I forget the citation was talking about that, Rob. Apparently, TEEs, they did either EGDs after patients who had got TEES. And a fair number of them actually had esophageal injury or erosion. Alan, you probably know about that. I heard about it at least. Kind of interesting. I agree, it's not inconsequential. But I think it's going to add value to the decision-making, [INAUDIBLE] certainly we'll get it.

MARIO CASTILLO-SANG: Yeah. So here are the results of the polling questions. These are interesting and I think we should go through them. So how would you approach this case, repair or replacement? If you look at it, the majority of the audience polled that they would repair the valve. 71%. I think we all agree that degenerative disease, we're going to give it a shot. And we're definitely going to go for replacement as a primary goal. If you attempt to repair-- this was a tricky question. How much time across clamp are you going to spend? And for to talk about that question, let me go to the next slide.

Let's adjust. And can you-- oh, there it is. This is the next slide. So this is the intraoperative finding-- oh, sorry. I was fearing that would happen.

This is the intraoperative finding of that particular valve. So yeah. So flail posterior, flail anterior. Complex. Now, it may turn out to be a longer case than you had bargained for. How much time are you willing to spend-- this is for Tom and Robert-- in looking at this valve before you say, OK, at this point I need to start thinking about replacement?

TOM NGUYEN: This patient is relatively young. And looks like doesn't have a whole lot of other medical problems. I would be very aggressive about doing what I can to repair this valve. I agree, it's complex. But looking at what you're shown here, I think it's actually very repairable. I'm of the respect camp. So I'm pretty aggressive about chords. And in fact, because of the anterior leaflet prolapse, the only way to really repair it is to use chords, whether NeoChords or chord transposition.

So I'd be pretty aggressive about using cords to repair the valve. I'd probably put at least four chords in a posterior leaflet and probably another-- at least probably four chords in the anterior leaflet and repair that defect, that hole, in the anterior leaflet as well. I'd probably just primarily close that hole. Timewise, I use del Nido. And most of the time, we can usually get it done within one shot of del Nido. If I have to redose, then I will. But I feel relatively confident-- you should be repaired this within 60 or 90 minutes of crosscurrent time.

MARIO CASTILLO-SANG: Robert? You're muted.

ROBERT SMITH: I agree with Tom. This is a valve that needs to be repaired, largely. And I think-- this goes to Allen's point at the beginning-- for a patient who's 50 years of age, he's going to work on sending him to someone who has a fair experience with mitral valve repair surgery. I think that in-- from a time limit standpoint, I think you have a lot of time in a 50-year-old with no concomitant cardiac disease to get this done. I think the bigger thing is making sure that you have great imaging in the OR so that you can do a good assessment afterwards. And then, the next point would be, well, what if you do all that stuff and then it doesn't look good?

MARIO CASTILLO-SANG: Very good point.

ROBERT SMITH: And I think that's where you start looking at, well, where's your bailout strategy? But I also am a significant chord user. In fact, I can hardly think of the last set of valves that-- unless they had a MAC that required some resection. So it's a pretty infrequent event. And so I would use multiple chords here for the repair strategy. And then usually just a posterior band as well.

MARIO CASTILLO-SANG: I tend to agree with everything you guys have said, for sure. For the surgeon out there who is starting out, whether it's minimally-invasive or just simply starting out, who ultimately will have to face a case like this, what would be your best pearl, your best advice, that you could give them when you see a challenging case in terms of exposure, cardioplegia, what do you try first-- what's your best pearl?

ROBERT SMITH: I think the first thing here is if you're new and starting out, or if you don't have much experience with mitral valve surgery is have humility. Have one of your senior partners there with you who've done a lot of this. This is-- where we're talking about a 50-year-old on the other side and-- but degenerative valve disease, you are making a gigantic impact on their long-term survival with a repair. So we want to make sure we've got that strategy going.

And with a senior partner, or someone who has a lot of experience with valvular heart disease, you're now making a combined effort on thoughts on how to make this happen so that hopefully you're speeding the process through. So I think all those are really important. And additionally, while you're doing this minimally invasively, I would do it robotically, Tom would also do it minimally invasively I think that's right. Is open surgical approach, if that's your comfort level and you're going to have more opportunities to get more please if you don't use del Nido like we all do, great. Then make it an open approach. It's going for the repair strategy.

The next thing though is, when do you cut and say, hey, we can't do this? And guess what, you come off, you really take a look at your valve after the heart's beating well, you give it plenty of time to come back and get your electricity repolarized, everything else. And you make those full assessments. And if it's not working and you don't have a great idea of what to do, make sure the heart's rested plenty and then have a quick strategy of going back and maybe doing a replacement at that point, would be what my recommendation is.

But this heart, more than likely, even though there's some reduced LV function, this heart likely can tolerate two pump runs. 75-year-old, 80-year-old, Probably not. But a 50-year-old, I think they could.

MARIO CASTILLO-SANG: Tom, anything you want to add?

TOM NGUYEN: Yeah, I'll add, when I have a conversation with patients, I tell them that I have three priorities when do the operation. And they sound pretty basic, but it's important in the order of it. First, I want to do the operation safely so they can go back home to their family. Two, I want to address the pathology of why they're there. And they're there for a leaky valve, so I want to make sure I leave the operating room with a valve that doesn't leak any more. And then, thirdly, is the incision location. Whether it be by thoracotomy, robotically, sternotomy.

For the most part, we feel pretty confident that we can do all of that via minimally invasive approach. But when in doubt, I always default to those priorities. I want to make sure I do the operation safely, I want to make sure I leave the operating room without a leaky valve, and if I'm repairing it, and after maybe the second pump run and it's still leaky, then I will go back and replace, because that's why we're there to begin with. And again, the incision location, I think, is tertiary in that decision analysis.

I do want to pose a question, too. If you repair in this Barlow's, Mario, Rob, would you use a partial ring or a complete ring? Now, through all that context and the fact that the patient is 55, And if the patient does have a kind of failure, and let's say the patient's 70 and higher-risk, then a partial ring is a little bit less accommodating for a valve in ring as opposed to a complete ring. So what would you guys put?

MARIO CASTILLO-SANG: I'll take a stab at that. I don't use bands, I use full rings. And but it's out of training and out of comfort level. There's some data to support that, but at the same time, there's also data to support that bands can do well, too.

But I think, in my situation, it's more of a comfort level and understanding how the world will react to or interact with that full ring. It's my understanding of how it will turn out to look like. I'd be worried that if we are planning on a valve and ring in the future with an anterior leaflet that's intact that we could get in trouble. I know there are techniques to mitigate that, and perhaps Allen can touch on those. But I would be-- I would use a ring just out of habit or practice. Rob?

ROBERT SMITH: Yeah, so I use bands here. I particularly don't like limiting or freezing the anterior angular motion that occurs during systole so I like to see that thing get as atrialized as possible with its-- during systole where it kicks then it drives the leaflet coaptation. And I think the more leaflet coaptation that you can drive, the more you reduce some of the degenerative capacity over time. Because you're getting a lot of good leaflet coaptation, you're taking some of the pressure off the subvalvular structure. So that's my theory on how to choose about bands and what not.

Now, if there is considerable left ventricular dysfunction and you've got more of this mixed functional component that goes into a long-standing DMR patient with marked annular enlargement then sometimes, yeah, I'll use a ring. But it's a more rare occurrence to do that. Regarding down the road [INAUDIBLE] valves, you're absolutely right, Tom. I think that's one of the issues is, you take out that valve and valve option. However, you still potentially have transcatheter mitral replacement option. And you're talking about a 55-year-old who will hopefully now be 75 before that's an issue. Or you're also looking at edge-to-edge therapy and now a really big annulus, and so you have a little bit more room to work with.

So I think you haven't really eliminated all your transcatheter options, you've really just minimized the opportunity for doing a valve and ring, or taking that off the table, but you still have some transcatheter options down the road. When we look at fixing this complex valve pathology and we talk about the number of surgeons who do enough mitral work to really get something like this done really, really well in a short period of time, you start shrinking some of the numbers down to mitral valve surgeons. And when you start talking about the number of interventional teams that feel really comfortable dividing an anterior leaflet for valve and ring, you really even shrink that number considerably further than you would. So that is not a straight up easy procedure to do. It's doable. And I'll let Alan comment on this. But it's not an every day in the cath lab or interventional suite procedure.

MARIO CASTILLO-SANG: What's the name? Is it BASILICA procedure, is that what it is?

ALAN ZAJARIAS: It's the LAMPOON.

MARIO CASTILLO-SANG: This is--

ROBERT SMITH: LAMPOON.

ALAN ZAJARIAS: Yeah. BASILICA is for the aortic valve [INAUDIBLE] to minimize the amount of coronary obstruction. But the LAMPOON is what's a device to electrify a guide wire and cutting or severing the anterior mitral leaflet. And I think the discussion is incredibly powerful. As the surgery team, I think, understands that not every ring is created equal, the dimensional cardiology team is learning that at a very fast pace. Choosing the right ring that potentially is flexible enough to circularize when you put a valve inside it is something that we're learning because not all of them do that. And as a result, trying to force a decision for something that's going to happen 10 to 15 or even 20 years from now makes it even more complicated. This patient should, potentially, have their LV shrink.

And one of the main caveats that we have for the valve in ring type of procedures is the risk of a LVOT obstruction, as Robert had mentioned. Particularly if the anterior leaflet is very large. Or potentially, if the angle between the aorta and the mitral is very acute, or not obtuse to say the least, and as a result, you definitely pose a risk of LVOT obstruction. So it's great that we can be set up for the future. But sometimes the future is pretty difficult to predict.

So I think the ability to place a clip on a previously repaired valve also will depend on the length of the posterior leaflet, which is one of the major determinants of appropriate leaflet insertion into the current generation clips. So that's also something to consider. In this case, both leaflets are pretty redundant, so it is likely that potentially in the future we would be able to clip something. Or maybe in the future, some of these other chords that were not replaced may actually tear and cause severe MR that caused the original pathology this time around.

TOM NGUYEN: I want to ask Alan a quick question. You brought up clips and you brought up you know DMR. So this patient's going to go on the internet and say, hey, I want a mitral clip because it's the best way to do it. And she's going to be seen by a cardiologist. The cardiologist says, OK, look, those leaflets are grabbable. The orifice area is big. I can clip it. What would you-- what's the conversation you would have with the patient about clip versus surgery on this particular case?

ALAN ZAJARIAS: I think with the information that Mario was kind enough to present, I mean, this is a low-risk patient. Low-risk patients should have therapy that is, until proven otherwise, is considered the gold standard. And for the low-risk patient, the successful mitral valve repair will be incredible, it will be long-lasting, and they'll have very little residual MR. These patients-- well, in the Everest trial, if you remember, almost a decade ago, patients that were randomized to either surgery or a mitral clip procedure.

The biggest advantage for them for the low-risk patients was less risk of bleeding, as opposed to residual mitral regurgitation, which was always higher in the clip patient. So this patient should be considered for a surgical repair to begin with. And that's one of our upfront conversations, unless you would be considered for a clinical trial that would compare the efficacy of one versus the other. But not a commercial implant.

MARIO CASTILLO-SANG: Yeah, very good points. Tom, thanks for bringing that up. On that same vein, I think it'd be valid to ask if this patient was between 60 and 65 years old, and the person starts getting into that question of biological valve, what is your conversation with the patient in the prospect of a valve involved in the future?

ALAN ZAJARIAS: I think at age 60 or 65, it is likely that he will outlive his bioprosthetic valve. However, it's not necessarily an unreasonable option. 10 years from now or 15 years from now, if that valve degenerates, you're talking about somebody who would be now in their upper 70s. And as a result, will likely be a higher-risk individual. We have good data to support high-risk patients undergoing mitral valve and valve. The moderate data set is currently being captured. There is a registry that we are fortunately part of. It's the PARTNER of three mitral valve-in-valve trial, a registry for intermediate-risk patients we're actively enrolling. But we'll have that information available later.

There is a TVT registry data that's been published that shows that in patients who have an STS around 11%, the 30-day mortality for mitral valve-in-valve was 4%. And the one-year mortality was close to 13% or so. In the Woo paper, you could see that patients who had redo mitral valve surgery in the intermediate-risk or in the intermediate age group had an operative mortality of 14%. And so mitral valvular valve is definitely a good procedure for patients who would meet the indications for it. Not quite good for everyone, but definitely for patients who would meet the indications for it, is a very good venue.

MARIO CASTILLO-SANG: OK.

ROBERT SMITH: I think--

MARIO CASTILLO-SANG: Tom?

ROBERT SMITH: --one other piece to bring me up there, though, is whether they're 60, I think 60 and 65s are young still. But particularly at this age, and we're talking about we failed at the repair, we need to do something else, you're looking at a replacement strategy. One of the things-- this is going to be a big valve. But you really need to make sure you're putting in a big valve if you're looking at a down the stream valve-in-valve option. Because one of the issues is, even though the transcatheter valves-- balloon expandable transcatheter valves when they go in, they're have extremely low profiles and they fill up the valve area, I mean, they're still limited by the same framework. And now they're taking up some more room. So small valves do not do well with valve-in-valve.

And so if you're thinking on the line of, hey, I want to plan for the future somewhere, make sure you're putting that in your calculation. The nice thing about mechanical valves is they are very large, even in the smaller sizes. So that brings up the making sure you've got good hemodynamics and how it works out.

MARIO CASTILLO-SANG: Yeah, Very good.

ALAN ZAJARIAS: Rob, that's an excellent point about the size of the bioprosthestic. And I think it's super important to emphasize that we have to focus on the internal diameter of the valve, not of the sewing ring of the valve. And not every bioprosthetic valve is created equal. So a 29-millimeter from one company is not the same as a 29 from another company. And it's really important to really focus on what that internal diameter is like.

MARIO CASTILLO-SANG: I would close this discussion by this particular case by saying that just like the panelists have said, Rob and Tom have mentioned that if you're on your second clamp and it doesn't look good, replacing this valve in this young individual, giving a mechanical valve will give them durability and good hemodynamics that will carry them on to old age. Let's go to the last case. That was a great discussion, guys.

The last case. This one gets a little-- I think it's going to get a little stickier. This is a 60-year-old male with a history of CAD. But has had prior stenting and PCI and presents to the surgeon when he's been diagnosed with severe mitral regurgitation. It appears to be eschemic in nature. And we'll take a look at the echo of his heart cath. Last was done when they revascularized him and everything looked open. And we'll show you the echo next. Whoever wants to take a stab at that?

ALAN ZAJARIAS: I could do it, if you want. So there's definitely evidence of severe MR. It appears to be posteriorly-directed. The mechanism is likely leaflet restriction-- posterior leaflet restriction probably coming from that infrabasilar aneurysm that you had mentioned. And that is the mechanism of this MR.

MARIO CASTILLO-SANG: OK, why don't we go ahead and give the polling questions for this last case? So Robert, what are you thinking here when you're seeing this patient? Just showed up in your office. I know that the conversation probably has changed a little bit since January since the circulation of the 2020 guidelines. But what are your thought processes right now?

ROBERT SMITH: So, I mean, first off, when I see a patient like this in my office, I usually will have preevaluated their TEE images and I will have sent this patient to our mitral valve clinic, where we actually have a heart team approach for looking at these patients. So we actually see everybody together. We have echocardiography, interventional choreography, interventional cardiology, and cardiac surgery see patients together. And this FMR patient, which is what this case is, is a perfect example of something that needs multidisciplinary thought. So that's first thing.

The second thing is, I want to make sure that this patient, as we look through them and are prescreening them, has already been looked at and evaluated for guideline-directed medical therapy. And I'll let Alan get more into this discussion. But guideline-directed medical therapy is the basis for everything we do in these patients with functional mitral regurgitation.

So I think the key thing that just to start out with as a surgeon, going into seeing a patient like this is, number one, don't think that surgery is the right thing to start with. And number two, grab your colleagues, who deal with this a lot more than you do. All the pieces and parts around the heart. And the medical therapy piece, because that's the basis of everything we're going to do next. So this is a heart team patient. And that's the first thing that I would do.

And then, as we get into what are our options down the road, we can talk about the transcatheter options, surgical options. But really, it's doing all that and making sure we really knocked out and zoned in on guideline-directed medical therapy because that valve, in the setting of optimisation-- which includes CRT when required-- can look a lot different.

MARIO CASTILLO-SANG: I agree. Tom?

TOM NGUYEN: A lot of thoughts. I think we as surgeons and clinicians need to recognize that MR is an MR is an MR. And we use a term very loosely, but we need to dig deeper and find out the etiology of the MR. And in your case scenarios, you did a really good job. You highlighted the rheumatic, the DMR, and the ischemic functional MR. It's important because the treatment options are very different. The analogy is that cancer-- we use cancer are sort of loosely, but there's a big difference between pancreatic cancer versus basal skin cancer. So I think that's important. When you say, you get a cardiology consult from cardiology, hey, the patient's MR, I dive deeper. I say, hey, what's the ideology of the MR, what's the pathology, where's it from? Because that helps dictate my decision a little bit.

We know that in ischemic MR, the Acker paper in *New England Journal of Medicine* that there's an increasing trend towards replacing these cases because there's a higher risk of recurrence. And that's the approach that I've been doing recently. And the reason why, I think, is pretty straightforward. And even the HA guidelines helps to divide this. They call it primary MR versus secondary MR because the pathology can either be in the leaflets or it could be in the ventricle.

And if the pathology is in the leaflets and you fix the pathology in the leaflets, then the patient's doing well. But if the pathology is in the ventricle and all the other stuff, you're fixing the leaflets, well, you still have 99 other things that's going on. And the patients don't do very well. So that's why it's really important. So in this particular patient, recognizing all that, I would actually err towards replacing the valve. But also, as Rob alluded to, make sure they've really been optimized from a medical therapy standpoint.

I know we're going close on time, but I just want to touch on something that I think is controversial but it's subtle. There's a recent mitroclip indication for potentially clipping patients who are FMR. Before it was only DMR patients. But the irony to me-- and I think it's this huge discrepancy because in the surgical world, we're moving towards, hey, it's OK, if not preferred, to do a replacement in patients who have FMR. But in the cardiology world, hey, we're-- it's OK to repair them and put a clip on, we don't have a whole lot of data. I know I've opened a can of worms, but I do think it's important discrepancy in the way we're looking at the pathology. And I'd love to hear all y'alls thoughts on that.

MARIO CASTILLO-SANG: So let me take it from there for one second, because I want to go with a polling question. So the first one is, I find it very interesting that we are almost 50-50 split. Evenly with 59%, 41% of the audience that would replace to a mechanical 59%, biological 41%, undertook it as an operation. And I think that the New England paper on ischemic MRIs is really percolated like just like you're saying it in the audience of surgeons, in the ears of surgeons, where you can see in the answers, 71% of the audience would replace as well. And only 29% would repair it.

But one of the things that I would like Alan to comment is exactly what you've said. I mean, I know that there are criteria for these to be treated with transcatheter edge-to-edge repair. What can you tell us about those criteria? And how does this one fit into that? You're muted, Alan, sorry.

ALAN ZAJARIAS: Sorry. Echoing what Robert and Tom have mentioned, a multidisciplinary is key. And we learned that when the aortic valve and we've adopted that as we treat patients in the heart failure or even in the EPV arena with refractory arrhythmias.

So in this case, these patients have to be on a beta-blocker. Or they have to be on good guideline-directed medical therapy at least for a period of three months. And make sure that you're [INAUDIBLE] these medications appropriately. I think the beta-blocker is key. I think the use of Entresto instead of an ACE or an ARV is also very important. If you can tolerate aldactone that's great.

Considering patients for CRT, as a fair portion of them may improve and may not need your surgical services or my interventional services. Guideline therapy is there for a reason. And it's totally fine not to operate, or it's totally fine to just prescribe medications that actually are very helpful and lifesaving.

If this patient has finished their GDMT and is still quite symptomatic, then I think the next important step is knowing what the LV function is like, what the OV dimensions are like. If the left ventricular dimensions are very large, or the LV is greater than 7, then it is unlikely that a repair, even if successful, may impact to their survival. As you know, there are two good mitroclip trials. One is called MITRA-FR and the other one is COAPT for this patient population. And the results are vastly different, mostly because of the type of the patient populations that were enrolled, the success of the procedure, and the medical therapy that was applied prior to. So that's actually the key to a good successful edge-to-edge repair from a catheter perspective.

MARIO CASTILLO-SANG: So this patient, just to close the loop on this patient, this patient underwent an operation and mitral valve replacement, not a repair, to close the loop on the questions to the audience to-- and it was a mechanical valve by virtue of a conversation with a patient. I think what you all have touched on-- Alan, if you want to take over, this is the new guideline that has been put out by the AHA with a 2a indication for a transcatheter edge-to-edge repair for those who have secondary EMR.

And then, it is important that we tease out which of these patients are going to really benefit from a transcatheter edge-to-edge versus an operation, once they've failed GDMT. And that's where Robert was very well saying a tag team approach is extremely important because [INAUDIBLE] you cannot come up and say he'll benefit or she'll benefit from an operation or a clip. It's really a conversation and really analyzing the case on a case-by-case basis.

To Tom's point, to be indication was that a replacement versus a repair in secondary MR. And probably based out of the New England paper. And in fact, it is based out of the New England paper from years past. All right, Allen.

ALAN ZAJARIAS: Thank you, Mario. So it is critical, when we assess these patients with secondary MR, to one, make sure they're in guideline-directed medical therapy. And just like their senior cardiologist or senior surgeons you could ask for help, there's heart failure specialists, there's seasoned cardiologists that are willing to help and to make sure that these patients are following the appropriate treatment guidelines or algorithms. MR has become very difficult to understand or diagnose. And we, first of all, want to make sure that your patients are symptomatic. They have severe MR by good echocardiographic criteria.

And we have to understand the loading conditions. Sometimes patients come in with very little MR, and a couple of days later, if you reimage them, if their blood pressure seems to be out of control, their MR will be very, very elevated. So please make sure that they're on appropriate medications that are required.

And then, our previous patient was already revalscularized. But if the patient needs to be revascularized, there is no doubt that revascularization with the surgical potential strategy and a mitral valve surgery at the same time is key. Now, if the patient does not need to be revascularized, and your ejection fraction is appropriate or greater than 50%, and you still have afib or significant symptoms, then a surgical approach is key for success. Now, in those patients who now have LV dysfunction who still persist to have symptoms even on GDMT who have a favorable anatomy, which means that their rejection fraction is greater than 20 and less than 15, whose end systolic dimensions are less than 70 millimeters, and who do not have severe pulmonary hypertension-- and I would add to this who do not have severe or moderate to severe tricuspid regurgitation because that is also a harbinger of worse outcomes-- transcatheter edge-to-edge is appropriate.

On the other hand, if the anatomy is not appropriate or not conducive for good edge-to-edge, it's-- having an unsuccessful procedure doesn't help patients either. That is basically what we found out about--

MARIO CASTILLO-SANG: Mitral.

ALAN ZAJARIAS: --the fate of medical procedures in mitral. So that's why selection is critical. And the selection is done, as Robert had mentioned, with the team approach of a echocardiographer, a cardiologist, and a cardiac surgeon. valve-in-valve is something that's incredibly attractive. We have heard about valve-in-valve aoritic in the past. Mitral valve-in-valve is currently getting a fair amount of momentum. I think the idea of doing a transseptal procedure is very exciting. The outcomes are likely better with a transseptal than a transapical procedure, unfortunately. But they're still very, very, very successful.

You can see here, in data from the DVT registry, where patients who have a previous mitral valve surgery was estimated operative mortality with the SES promise is around 11% for redo MVR. The procedures were 96.8% successful with a 30-day mortality of 5.4%, which gives it an orderly ratio of less than five, which is spectacular. With a relatively low risk of stroke and a relatively low risk of valve thrombosis. At one year, the mortality increases to 16%, probably because of the type of patients that we're seeing. The risk of stroke does increase as well.

And it is very important to understand that patients who have transcatheter mitral valve-in-valve procedure should undergo oral anticoagulation therapy in order to prevent valve thrombosis. And what Robert mentioned earlier about the possibility of doing-- of placing a large valve, it is very important to make sure that the valves that are placed are larger. It is rare that-- or almost impossible for anybody to do a mitral valve-in-valve procedure and place a 20 or a 23 millimeter balloon expandable valve. That would give patients significant stenosis and may not assist them in any good shape or matter. But 26, 29 millimeter balloon expandable valves are highly effective for the appropriate patient population. And the CT scan are key to make sure you will not have any obstruction.

I know that we're pressed for time. But I do want to echo that both tissue and mechanical prosthesis are safe. And the patient population that they're applied on will depend on their efficacy and the longevity of the patients. So as you can see here, these survival curves are parallel. But mostly, they're parallel just potentially for the age group at which patients are being treated.

And likely, quoting the Woo paper that was mentioned earlier, in the mitral valve specifically, you could see that it's only in the lower-risk population, where there appears to be a larger difference in survival in patients who were treated with a mechanical prosthesis. But at the end of the day, you are basically choosing which type of morbidity you're going to expose your patients to. Mechanical prosthetics, at a 15-year survival, are very similar in this middle-age group. However, your stroke rate is 14%, your bleeding rate is 14%.

Bioprosthetics don't necessarily have that bleeding rate, but they have a risk of reoperation of almost 50%. So you have to decide if it's worth it to pay the risk up front, pay the risk in the future. And that's where the lifetime discussion or the lifetime management is incredibly important, and the multidisciplinary discussion comes into place as well.

MARIO CASTILLO-SANG: OK, so if you want to click on the next while I regain control? Thank you. I think it's-- let me go back one. I think with that last slide that you talked about the risk of thrombosis and bleeding, I know that On-X, obviously, looked at for a lower INR indication. At least, the data is being submitted to the FDA, I think by next year. And more to be learned about this. But how would lower indication for an INR of 2 to 2.5 impact your decision process in these patients? Conceivably lowering the risk of bleeding and making it easier to get to a target INR in a shorter period of time. I think that's something that's very thought-provoking and it could change some of the decision process and the conversations that we have with our patients.

ROBERT SMITH: Yeah, Mario, I completely agree with you. I think that's a critical piece here and we'll find out more to come. But most of these patients who come in with functional mitral regurgitation are generally not healthy. And oftentimes, their past medical histories are complicated by the number one thing that complicates people with mitral regurgitation, which is atrial fibrillation. And they are generally on some sort of anticoagulation regimen. And in the setting of atrial fibrillation, if you're on a Coumadin regimen, you're running right in that range. So this would just put you into that range and maybe dock down some of those other potential complications. Now, it also will eliminate your risk-- or your ability, rather-- to get into a NOAC therapy, at least as of right now. We haven't seen that to be applied to a mechanical valve situation.

So it broadens the discussion. It makes it a deeper discussion when talking with your patients. Particularly about, if this trial ends up showing safety at a lower INR. It's a really important piece, particularly for that younger patient you're presented with functional ischemic regurgitation.

MARIO CASTILLO-SANG: Very good. These have been fantastic discussions on all the cases. And I think I wanted to have the audience leave with something. And so Alan, if you go ahead and give us your takeaway points?

ALAN ZAJARIAS: Thank you. I think my key takeaway point is that whenever we approach patients with valvular heart disease, we do have to plan for a lifelong management. We can't just plan for a very short-term therapy. It's not like treating instant restenosis, if that reoccurs. We want to make sure that lifelong management is discussed. And we want to make sure that the patients are managed both by the team of individuals that address their care-- heart surgeons, cardiologists, echocardiographers. That basically will allow us to decide what the right management would be.

I always would prefer a mitral valve repair, as long as it's durable and successful. I think the idea of trying to keep the patients with a lower range of anticoagulation, if deemed safe, will be spectacular. As the higher the anticoagulation level, the higher the risk of bleeding complications. I think transcatheter edge-to-edge repair is FDA-approved, as you know, for high-risk or individuals who have a favorable anatomy from a degenerative perspective. And for patients who otherwise are discussed in a multidisciplinary fashion, with the heart team approach for those who have FMR.

And I do think that bioprosthetic valves have a good role in patients who are older than 65. And I think the mechanical prosthetics are spectacular for patients who are younger, that you just want to do one long-term therapy for.

MARIO CASTILLO-SANG: Robert? You're muted. Robert, you're muted.

ROBERT SMITH: Oh, sorry. Number one, thanks for having me. I really appreciate it. And number two, it's been a really fun conversation to have with all of these guys. And hopefully, everyone's getting a lot from this.

I'm going to be brief on the top one. Yes, it's a shared decision-making process in your plan for lifelong management. Number two, I think it's not only about the medical part of this, but there's an anatomic part that always goes into this. And so, for those patients who are 65 to 70, or even a little bit above, if you're already on anticoagulation you may be a good candidate for a mechanical valve, particularly if you have inappropriate anatomy for valve-in-valve in the future. Based on the way current tissue valves are constructed. So that needs to be a very thoughtful discussion with the patient, and with a lot of engineering discussion to go along with that so that you're helping guide along the pathway of what's really possible in the future.

Next, patients who have narrow mitral valve annuli and by way of natural anatomy or prior congenital heart surgery, guess what? You want a valve that's going to provide you the biggest opening area. So again, there are a lot of times other prohibiting factors that may limit their ability to take anticoagulation. That needs to be addressed in the conversation. But oftentimes, I'm using mechanical valves there.

For patients who are otherwise young, my mechanical valve is the go-to for me. And oftentimes, the discussion is not that difficult to have when you're talking about this, unless the patient's female and desiring to be pregnant. And the complications that go in to trying to manage anticoagulation, particularly the fact that they should not be on Coumadin for that.

And then also, patients who have very limited access to health care and the difficulty of managing Coumadin in these patients, I think, is a very important piece to be brought up when you're having these discussions. So anyways, to me it's a shared decision. But you have to bring a lot of important information to that conversation and make sure the patient understands what your discussion's about.

MARIO CASTILLO-SANG: Excellent. Tom?

TOM NGUYEN: Thanks Mario. I think I COVID most of the talk's-- the points in the prior conversations. But I want to add a couple of things. One, it's a conversation with you and the patient. So again, the shared decision-making concept is important. It's a conversation with you and the heart team. And it should be a multidisciplinary collaboration and productive conversation. Number three, I think you have to know the data. And in some ways, I believe surgeons have to know the data better than other specialties, even the cardiologist. So I think we need to know the data. Increasingly, for myself, I find myself doing replacements-- mechanical valve replacements probably-- or replacements at a younger age than before, knowing that there are transcatheter options in the future.

Number four, we're surgeons but I always any soapbox I can get. I think it's important for us to stay involved, be the Rob Smiths of the world and be involved with transcatheter therapies, because at the end of day, it's here to stay. But in the light of knowing the data. I think it's important for us to also recognize that there's only one randomized control trial comparing mitral clip versus surgery that's averaged to in high-risk patients. So I know that's a different conversation for a different time point. But I personally believe the ACC, HA guidelines with that 2a recommendation for FMR is a little bit premature because there's not a whole lot of data for that. Again, that's going back, we need to know the data and do what's best for our patients. Thank you Mario, thank you Rob and Alan and [INAUDIBLE].

MARIO CASTILLO-SANG: Yeah, it was lots of fun doing this, number one. And I thank you all for putting all this time into this. My points are going to be very similar to yours. It's a conversation with a patient and their families. And their referring cardiologist and finding out what's best for them, it's-- in my practice, it's going to be a solid, for less than six years old they get a mechanical valve. And in between 60 and 65, there will be definitely a conversation. For those who are older than that I definitely err on the side of a biological valve.

And exceptions are few and far between, but the patients who, like Rob said, who have no reliable means of adhering to the therapy, or those who have a history of IV drug abuse, notwithstanding the age, will get a biological valve. But with that, I think we end all our cases and our discussions. And it was so much fun. And I think we're open to the conclusions here, which I think if we summarize that all, if we talk about a rheumatic patient that is in need of surgery.

You have the option of a biological or mechanical valve, and the [INAUDIBLE] are very clear. I think the European and American guidelines have now aligned in terms of the age [INAUDIBLE]. There should always be a conversation for those who have FMR. We have a new 2a indication for transcatheter edge-to-edge. A high team approach with guideline-directed medical therapy should be absolutely the first go to. And then the discussion of whether they have favorable anatomy. And then this question of a valve replacement with replacement favoring repair in the case of surgery.

And then, for degenerative mitral disease, repair, of course, number one. And if you cannot repair the breakdown into replacement or mechanical or biological, based on age, with a good conversation with the patient prior to. And then for those who are high-risk, transcatheter edge-to-edge to edge for degenerative disease I think that summarizes what we've discussed today, and I thank you all for coming in. I thank the panelists and I thank the audience for tuning in.