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# Advances In Heart Valve Repair







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#### Introduction



**Adam Pick:** Hi, everybody. My name is <u>Adam Pick</u>, and I'd like to welcome you to the webinar, "Advances in Heart Valve Repair". If I have yet to meet you, I'm the patient who started <u>HeartValveSurgery.com</u> in 2006. The mission of our website is simple. We want to educate and empower patients, their family members, and their friends. This webinar, which has had over 490 registrations from patients in countries all over the world, was designed to support that mission.

Throughout the webinar, you're going to be in what's known as "listen only" mode, but I would encourage you to submit your questions in the control panel that's most likely in the upper right part of your screen. The reason is we're going to try and answer those questions during the live Q&A session.









**Adam Pick:** Now, let's take a look at the agenda for this webinar. We're going to talk about heart valve disease. What is it? Then, we are going to have a very exciting conversation all about advances in heart valve repair. We're going to talk about clinical trials. We're going to have a live Q&A, and then at the end of the session, I'm going to ask you to complete a very quick, five-question survey to help us improve these community events in the future.



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# **Featured Speakers**



**Adam Pick:** Let's introduce the featured speakers. Typically, at this point of the webinar, I go on-and-on about all the achievements and the accomplishments of the featured speakers. Today, I'm just going to tell you we've got so much great information, I'm just going to let you know this. The clinicians on the line, Dr. Pavan Atluri and Dr. Wilson Szeto, have performed over 4,500 heart valve repairs or heart valve replacements. I can't think of a better team to be having this important conversation today all about heart valve repair.

<u>Dr. Pavan Atluri</u> is the Director of Minimally Invasive and Robot Cardiac Surgery at <u>Penn Medicine</u> in Philadelphia, Pennsylvania. If that wasn't enough, he's also the Director of Cardiac Transplantation and Mechanical Circulatory Support.







**Adam Pick:** <u>Dr. Wilson Szeto</u> is the Chief of Cardiovascular Surgery at <u>Penn</u> <u>Presbyterian Medical Center</u> in Philadelphia, Pennsylvania. Like Dr. Atluri, he's got other roles. He's the Vice Chief of Clinical Operations and Quality, Division of Cardiovascular Surgery. This is the point where we get to "Kick-off" the webinar. I'll do that by passing over controls to Dr. Wilson Szeto.



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#### **Heart Valve Disease Overview**

Circulation  ACC/AHA CLINICAL PRACTICE GUIDELINE  ACC/AHA Guideline for the Managation  Action Swith Valvular Heart Disease: E  Action Swith Valvular Heart Disease: E	<ul> <li>A Report of the American of Cardiology/American H Association Joint Commit Clinical Practice Guideline</li> <li>Update issued on Decem 2020</li> </ul>	College leart ttee on es ber 17,
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**Dr. Wilson Szeto:** Thank you very much. It's a pleasure for us to be here today talking to this fantastic group. Let's get started.

As you very well know, this topic is near and dear to our hearts, all of us. It is a major topic of discussion amongst our group, and as recently - as this past December - the <u>ACC/AHA guidelines</u> were updated, and without going through the details of this particular document, we will try to give you a flavor of some of the new updates in terms of valve repair and valve replacement in this area. It is very exciting to share that with you.





Dr. Wilson Szeto: This is a picture of your heart.

In general, there are four valves within a human heart. We will focus on aortic valve, and oftentimes, that is in association with some sort of aortic disease such as aneurysm. We're also going to focus on the mitral valve during the second part of the hour. We may even touch a little bit on pulmonic and tricuspid if time allows. This gives you an idea of the backdrop and the foundation for which the rest of this discussion will be about.



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# **Patient Perspectives**

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 What is (causes) valvular heart disease?
 What is my clinical outlook (i.e. what is heart failure) and prognosis?
 What are my treatment options?
 My quality of life is not the same, and I just want to feel better."

**Dr. Wilson Szeto:** We're all strong patient advocates at Penn Medicine. Both Dr. Atluri and I went into medicine because we really want to make patients feel better. From your perspective, we want to touch on some of this today. What is or are the causes of valvular heart disease? What is my clinical outlook? What is heart failure and what is our prognosis? What are some of our treatment options? Finally, really to strike the point about quality of life, wanting to feel better, is the goal of all of us involved in this process.





# **Team Approach to Heart Valve Therapy**

**Dr. Wilson Szeto:** To take a step back, I think I speak for Dr. Atluri and all of us at Penn Medicine, it is not individuals that make Penn Medicine work so well. It is the consummate team approach here at Penn. You can see here in the middle of this diagram is the heart valve team with patient advocacy. With that structure and that construct, all the options available will be discussed with a particular patient. I think that is a key concept. It is a team approach to providing the best care possible to all our patients, whether it's minimally invasive, whether it's catheter-based, whether it's some sort of hybrid or combined procedure, new technology, clinical trials, you name it. It all revolves around the patient and the "Heart Valve Team".



## **Aortic Valve Repair**



**Dr. Wilson Szeto:** The aortic valve, much like the mitral valve, is an important part of valvular function. Specifically, the aortic valve sits within the aorta and oftentimes, pathology or pathophysiology will be a combination of both valvular therapy and concepts as well as aortic concepts and treatment therapy. There will be some overlap here. I think in this discussion, I will try to demonstrate and show to you how each of those can interact and how that could affect treatment options and treatment plan and strategic approaches to how we can make you feel better.



#### **Minimally Invasive Aortic Valve Repair**



**Dr. Wilson Szeto:** Of course, we're talking about approaches, therapy and surgery. This first portion we'll talk about how we can fix or repair your valve through multiple modalities. We often get questions about how can we do this minimally invasive.

There are multiple approaches here at Penn Medicine. Both Dr. Atluri and I perform this where we can approach open-heart surgery through smaller incisions. Obvious benefit would be less pain, quicker recovery, and of course, cosmetic concerns. But, you can see here this is just two of the many ways that we can approach our surgeries with a smaller incision, a less-invasive approach that is patient-friendly and will lead to quicker recovery.



# **Aortic Valve Sparing Procedures**



**Dr. Wilson Szeto:** What are some patients that are candidates for valve surgery in terms of aortic surgery? It really does fall into two buckets: valve sparing versus complex repair.

Patients with aortic aneurysms and normal valves, cusps, patients with aneurysms and pathology, patients who present in acute extremis, and of course, bicuspid valves.

Those are some of the major categories that we're going to discuss.



## **Severe Aortic Insufficiency & Aneurysm**



**Dr. Wilson Szeto:** Here is an example of a patient with an aortic root aneurysm. You can see here on the right-hand side, a dilated aorta. On the left-hand side, an echocardiogram showing the color that you see - on the screen demonstrating leak or regurgitant valve.





**Dr. Wilson Szeto:** There are multiple ways of potentially replacing or repairing an aneurysm but at the same time sparing or repairing the aortic valve.

In general, there are two categories: remodeling and reimplantation. Without getting into too much of the specifics, they are both technical aspects of how you can replace or repair the aortic root while sparing or retaining your native leaflets.





**Dr. Wilson Szeto:** On the left-hand side, you can see an echocardiogram demonstrating a dilated aortic cardiac root.

On the right-hand side - after repairing and removing the aneurysm - you can see that the aortic leaflets are pristine. They are normal. They are trileaflet. It would really be of value and benefit to the patient if we can repair and save this valve. That is what we did with this procedure - a valve sparing or valve retaining operation where the patient's native valve is retained and spared.



# **Bicuspid Aortic Valves**



**Dr. Wilson Szeto:** Transitioning to a topic I think many of you have questions about and is becoming more and more discussed in the literature are patients with <u>bicuspid aortic valves</u>.

You can see here, these patients will also have an aneurysm or aortic pathology associated with leaflet pathology. You can see on the left-side they are predominately either <u>stenotic</u> in the top left-hand corner or the leaflets are nimble and pliable. However, they do not come together well, and you can see a gap there on the bottom left-hand side. These valves tend to be <u>regurgitant</u>. Those are patients tend to be younger.



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**Dr. Wilson Szeto:** BAV is common – it is the most common congenital abnormality affecting the aortic valve, affecting 1-2% of the population. A portion of these patients, 20-25%, will require some sort of aortic repair. Younger patients tend to present with regurgitate valves, while older patients tend to have stenotic or valves that are not opening as well.



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**Dr. Wilson Szeto:** There is a spectrum of bicuspid aortic valves.

I'm going to focus now on the younger patients - likely with a higher prevalence with regurgitant presentation because these are the patients that would benefit most from a valve repair.





**Dr. Wilson Szeto:** Here is an example of a patient with a leaky valve that we feel would be a good candidate for a repair strategy.

You can see here, again, an echocardiogram shown in color that there is a leak or regurgitant pathology in the aortic valve.

Blood is traveling backwards as opposed to going forward with each cardiac cycle.







Dr. Wilson Szeto: This is what it looks like on the inside.

A valve that has a cleft that is – although working well is not able – opening well is not able to close appropriately.







**Dr. Wilson Szeto:** Repair techniques such as this - where the cleft is resected and the leaflet is brought together - is a very effective and durable repair strategy,

Again, this provides value of a repair to a younger patient.





**Dr. Wilson Szeto:** Here is the after result of the repair.

Compared to pre-repair, you can see the regurgitation is no longer present.

This would represent a very satisfying durable outcome for this patient.





**Dr. Wilson Szeto:** Here is another example of a young patient with a bicuspid valve and regurgitant lesion. Again, you can see on the left-hand side in color a valve that is leaking. Blood is going backwards.

On the right-hand side is an interoperative photograph. You can see here – in contrast to the previous patient where there's a cleft - you can see there is a defect and malcoaptation of one of the leaflets.





**Dr. Wilson Szeto:** Slightly different strategy, but similar concept. That leaflet, that gap is then reapproximated with a patch. You can see here in the top left corner a defect, and on the lower panel after reconstruction with a patch, it is potentially going to be competent,

You can see here that on the picture it comes together nicely, suggesting this will be a competent valve.





**Dr. Wilson Szeto:** Here is echocardiogram after repair. Similar concept as the previous echocardiogram. You can see here the regurgitant lesion, the leak that's going backwards into the ventricle is no longer present.

Again, a very satisfactory, likely a durable repair moving forward for this young patient.



# Why Repair The Aortic Valve?



Dr. Wilson Szeto: Why repair? Many, many obvious reasons.

Obviously, a prosthetic valve related event would be avoid because it is your own valve, and we're able to repair it satisfactorily.

Most believe that it is going to be durable than anything that's a prosthetic.





Dr. Wilson Szeto: There are data out there suggest this.

This is just one group out of many.

One center of excellence out of Europe demonstrating their experience with over 600 repairs. There are very low events of complications, less than 1% per patient per year, and the freedom from reoperation is extremely high over time - over 10 to 15 years.





**Dr. Wilson Szeto:** Here at Penn Medicine, we have also been part of this journey, understanding how to repair the valves in a way that is durable with good long-term outcomes.





**Dr. Wilson Szeto:** Understanding the geometry and understanding how to repair these valves, we have also demonstrated very good outcome in the short-term as well as long-term period with very good reproducibility, low gradience, highly functional valve that truly represents what a native valve can do in the best scenario.





**Dr. Wilson Szeto:** We've also learned other adjunct techniques to just primarily repairing valve.

These are techniques to reconstruct the annular structure of the aortic valve and the aortic root apparatus is important.



### **New Approaches for Aortic Valve Repair**



**Dr. Wilson Szeto:** There are new techniques that are being refined such as the Ozaki Procedure or the addition of a <u>annuloplasty ring</u> that will allow us to continue to improve the outcome not only on the short-term but, more importantly for young patients, durability of these repairs moving forward over periods of 10 to 15 years.





**Dr. Wilson Szeto:** Here are some outcomes of the adjunct, these annuloplasty rings. Clinical trials have demonstrated good outcomes, and it has now recently been FDA approved to be used in this country.

This is a big step forward for all our patients in this country.



# **Aortic Valve Repair Summary**



**Dr. Wilson Szeto:** In summary... Complex aortic valve repair is being more and more commonly performed.

It is becoming a very important treatment option for many patients today, especially younger patients. Number two, we're learning (as our experience accumulates) how to best manage these patients with bicuspid valves and oftentimes concomitant aneurysm disease. Finally, as we become more experienced, we're learning. We're getting better. The refinement in the techniques of a repair will certainly continue to improve not only short-term but hopefully long-term outcomes.



# **Mitral Valve Repair Indications**



**Dr. Pavan Atluri:** I would like to spend the next 15 or so minutes briefly talking to you about <u>mitral valve repair</u>. To be honest, I can talk about this for hours, So, it's going to be a little challenging in terms of bridging it down to a very short amount of time. When we talk about mitral valve repair, the mitral valve field encompasses many different disease processes, several of which are shown here including <u>mitral stenosis</u>. Now mitral valve repair is being done in very isolated situations for mitral stenosis, but stenotic valves can be repaired. There's then the broader category, <u>mitral regurgitation</u>, which encompasses degenerative valves, valves where the disease is intrinsically related to the valve itself. There's functional mitral regurgitation related to disease as a result of pathology in the heart muscle or the ventricle, which then compromises the valve function. Then finally, a broader category of endocarditis or infection of the heart valve. All these categories, to some degree or the other, can certainly be repaired.



# The "Golden Moment" for Mitral Valve Repair



**Dr. Pavan Atluri:** The real question that comes down to mitral valve repairs, what is the "Golden Moment".

When is the right time to undergo repair?

Any time we do surgery, we're talking about risk, and the Golden Moment is really a moment where the risks are lower than the benefits. In other words, the benefits greatly outweigh the risk and it's really very much in a patient's favor to undergo surgery.



**Dr. Pavan Atluri:** Now some of those broad categories, which are outlined in the latest AHA guidelines, but to briefly go over them includes symptoms. The most common symptom that I hear or that we hear when it comes to mitral regurgitation or mitral valve disease is shortness of breath. Why is that? The blood flow from the lung makes its way into the heart, so any time there's blood flow that is either trapped at the mitral valve related to mitral stenosis or blood flow that is going backwards from the mitral valve from mitral regurgitation, it backs up in the lungs and you often get shortness of breath. In early stages, it might be very insidious. I go on walks; I notice I can't walk as long as I normally do. I notice that I can't exercise as long as I used to, or a spouse. I see this a lot, spouses that tell me, "He's slowing down," or, "She's slowing down. I clearly notice this."

Second category, decreased heart function. Often we measure heart function either in ejection fraction, so an ejection fraction, or the left ventricular ejection fraction decreasing less than 60%, or the heart gets bigger. We talk about that in terms of dilatation, and that is we can either measure it when the heart contracts, which is systole, or when it dilates, which is diastolic, and systolic dimension greater than 45 millimeters and diastolic dimension rate of 60 millimeters. We're starting to talk about left ventricular dilatation Or we can start talking about other diseases that are starting to manifest as a result of mitral regurgitation. Patients can develop <u>atrial fibrillation</u>; patients can develop pulmonary hypertension. Every once in a while, I see patients who have strokes related to mitral valve pathology. Those might be other reasons to think about surgery for mitral valve disease.

Finally, often times when patients have flail segments, ruptured cords that many of you may have heard of, I tend to be a little bit more aggressive in terms of intervening on the mitral valve because those diseases, at least anecdotally, tend to progress faster than those patients who might have a <u>Barlow's valve</u> or valve disease related to excess tissue.



## **Asymptomatic Mitral Regurgitation**



**Dr. Pavan Atluri:** There is another broad category patients and those who we pick up mitral regurgitation or severe mitral regurgitation; might be during a physical exam, which is the classical description.

"I went to my doctor. They heard a murmur. I then got an echocardiogram. We found severe mitral regurgitation, yet I can go for 25-mile bike rides. I can continue to exercise. I feel great." The question arose – and this is actually a monumental paper that came out of the Mayo Clinic where they evaluated those patients in Almstead County, Minnesota, and they looked at those patients with varying degrees of mitral regurgitation.



**Dr. Pavan Atluri:** What they found is those patients that have not mild or moderate mitral regurgitation but yet those patients with severe mitral regurgitation had decreased survival and increased cardiac events related to the mitral regurgitation.

The conclusion from this paper was in the presence of asymptomatic severe mitral regurgitation, we should progress to surgery on a very rapid basis.

Now if you look at the guidelines, it's a little bit cloudier, and I think it's a little bit beyond the time frame that we have here. I encourage you if you are in that cohort to talk to your cardiologist, talk to your cardiac surgeon. I'll talk to my patients for 30 or 45 minutes about this topic, about when is the right time to have surgery.

It's important to recognize that you have time. It's important to recognize that you can think this out and come to a good, educated decision with your healthcare providers.



# **Mitral Valve Repair Outcomes**



**Dr. Pavan Atluri:** So what do we know about valve repair? We do know that we can do valve repair, and we can do very good valve repairs with very good long-term data. Tyrone David from the University of Toronto – and of course a nationalized healthcare system where they can follow their patients for a very prolonged period of time, something that, by the way, we're starting to do at Penn Medicine as well.

When he looked at those patients that were surgery 20 years out from surgery and looked at durability of repair, you see that those patients that underwent mitral valve repair have very, very good, long-term freedom from mitral valve reoperations out to 20 years.



**Dr. Pavan Atluri:** The important thing to understand is that before you even start thinking about approach, always start thinking about can the valve be repaired? What's my best chance of valve repair?

Always think about the long-term, and then we can start tying in the short-term factors and the short-term recovery factors that might come into play when it comes to talking about approach.



# **Mitral Valve Repair Durability**



Dr. Pavan Atluri: This data has also been replicated out of other groups.

Here's a group, specifically Michele De Bonis, a very well-respected heart surgeon out of Milan. He looked at a cohort of his own patients out to 19 years and found that less than 5% – 4% of patients had to have re-operation at 19 years and very few patients had recurrent moderate or worse mitral regurgitation. Valve repairs can be done – they can be done very reproducibly with very durable results.



# **Mitral Valve Repair Approaches**



**Dr. Pavan Atluri:** There are multiple different approaches actually to being able to repair these valves, and some of them are listed here. There's sternotomies, which is the full length of the breastbone. It's a very good, very tried and true approach and quite honestly, it's the "gold standard" that we compare all approaches to. There's partial sternotomies, and some people describe incisions on the top part of the breastbone. Some part – people describe incisions at the bottom part of the breastbone. There's the right thoracotomy, so incisions in the right chests. There's a few isolated reports of coming at the mitral valve from the left chest. Then there's the broader, minimally invasive approaches, which we'll get into briefly.



## **Minimally Invasive Advantages**



**Dr. Pavan Atluri:** So we talk about minimally invasive and Dr. Szeto touched upon this. There's really broad categories that we talk about in terms of improvements. It's not in terms of the long-term; it's really short-term. It's rapid recovery, and that's either length of stay in the ICU or in the hospital; coming off the ventilator and then returning to activity quicker. We demonstrated all these advantages when it comes to minimally invasive approaches There's also signals and when we looked at our own data set and data that we published here at Penn Medicine, we've seen decreased blood transfusions. We've seen improvements in pain, in quality of life. There's, of course, the cosmetic benefits and there's even signals that maybe there's increased rates of atrial fibrillation with these smaller approaches



# **Port Access Mitral Valve Repair**



**Dr. Pavan Atluri:** There's two approaches that I'm going to go over briefly that we utilize at Penn Medicine.

One is a port access, which utilizes a 5 millimeter high-definition camera, and the other's a robotic approach. For both of these approaches, it was really important that we were able to manage blood flow around the heart. For that, we put in IVs in the neck which allow both monitoring of the blood pressure, and that's what you see in the blue catheter that's going into the neck there of this patient. Next to the cannula which drains blood from the heart and then if you look in the other side, that word says femoral artery. That cannula returns blood to the body. Then there's another cannula that's hidden in the shadows which allows drainage of blood from the lower part of the body.





**Dr. Pavan Atluri:** Once we mastered the ability to manage blood flow, then we are able to either get to the valve through a very limited incision, usually about a 5 centimeter incision just underneath the right nipple for men. For women, I make my incision about a finger or two above the bra line. Then, we utilize a 5 millimeter high-definition camera and long-shafted instruments.





Dr. Pavan Atluri: This approach provides really wonderful visualization.

What you see in the top left-hand corner is a ruptured cord to a posterior leaflet in the mitral valve. We're able to repair that. Then, in the middle is the placement of the sutures to then place the annuloplasty.

Then, the top figure on the right-hand side, what you see is a repaired valve. So, we are able to really do many complex techniques through that incision.



# **Port Access Post-Op Patient Pictures**



**Dr. Pavan Atluri:** These patients recovered very nicely.

You see that four weeks out, the incisions heal very well. This now allows patients, since we haven't disrupted the chest wall, to return to activity very quickly.



# **Robotic Mitral Valve Surgery**



**Dr. Pavan Atluri:** The other approach which has really become popularized during the past 15 years is robotic techniques for mitral valve repair. What you see here is it can get very busy at the bedside. I get the question all the time, is the robot going to do the surgery? Are you going to do the surgery? I assure you, the robot does not have a brain and I will be the one that does the surgery for you.

Yet, it's really a little bit more complicated, so there's a lot of ports. There's four ports that we place. One is the camera, and the camera is – I'm going to show you a video of this which will give you the visualization that we can get, but it's two cameras. It's a left-eye camera, a right-eye camera, and then what you see is me at the console. This is a three-dimensional visualization of what I'm looking at with the camera. Three other ports, so one is for my left arm, one is for my right arm, and the other is an atrial retractor.







**Dr. Pavan Atluri:** While I'm at the console, I've got my bedside assistants that are able to help me.

You can see that I can really do any pathology robotically, and you get really very, very good visualization on mitral valve.



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**Dr. Pavan Atluri:** Here's a video, and I want you to appreciate a few things. With the robot, I've got more degrees of freedom than I have in my own hands. The robot I can really work. Left hand, I can work. Right hand, I can spin it multiple different directions. This is – right now, we're opening the sac around the heart – called the pericardium Then, we're able to put a few stitches in and pull them through the chest wall, really fine stitches, which allow us to get some exposure. What you see there is we're looking at the heart from the right side, the ventricle or the pumping chamber where we're not really seeing so well. So two stitches get placed and we're always very careful.



**Dr. Pavan Atluri:** Right underneath that is the nerve that supplies the diaphragm which can of course affect breathing. We're always very careful to protect that never, gently retract. We've arrested the heart in between. What we do is we use a fingertip balloon that allows us to isolate blood from the heart. We're able to then very carefully get into the heart. We use electrocaudery which allows us to very precisely enter the heart. We're able to then use these very fine scissors and I've used these scissors to peel grapes; I've used these scissors in my early days of training to create little papier-mache little dragons, so they're really pretty fine instruments. Often they actually make the surgeon look better than they maybe even are because they give you such extra control.

What you see is we're entering the heart. Once you enter the heart, we're going to put in a retractor. That is that fourth port that I told you. The great thing with the robot is it gives me a third arm to work with. It's really a fourth arm; I've got one of those arms controlling the camera and now here's my third arm that's going to control my exposure to the valve. I don't get this exposure often, even when I'm doing a sternotomy and I'm right up against the heart. What's the nice thing? I can continue to drive that camera right up against the valve so I can get as close as I want. It actually makes me – I've worn glasses all my life. I can see even clearer with the robot.

The great thing is there's mobility. I've got multiple degrees of freedom. Anything I can do with regular instruments I can largely do with these robotic instruments also. Here you see that abnormal part of the valve that we cut out to reshape the valve. Then my bedside assistant's helping me manage the tissue on the bedside equipment. Here's a suture that's made out of Gortex, same material that's in many of your jackets. It's a great waterproof material but it's also got very good tensile strength. So, it helps put leaflet tissues back together with very good long-lasting results.



**Dr. Pavan Atluri:** When you see we're able to do very precise motions, very precise reapproximations of tissue – you see we're just going to put a bunch of stitches in, reshape this leaflet. Another primary tenet to mitral valve repair is that any repair we do – I can get a valve to be pretty competent just with doing the leaflet work, but it's really quite important to do something called an annuloplasty. That's where we put stitches around at least the bottom portion but the annulus is the part where the leaflet tissue attaches to the heart.

It's really important that we stabilize that tissue because research actually from the early 2000s reproducibly showed that if we didn't stabilize the annulus, the rates of recurrent mitral regurgitation were very high. I always make sure to stabilize the annulus, and that's what we're doing here. We put these stitches in. Once the sutures are in, we put in a fabric band which then acts to stabilize the annulus. I think there's some COR-KNOTs that'll be utilized to secure. See the metal COR-KNOTs? A great invention, allows us to save a lot of time by being able to – rather than tie, it's a little device that slips down, crimps a little bell around the suture, and really holds it tight in place and allows us to tie the suture with these metal crimps. We then close. Now we entered through the left atrium, so the collecting chamber of the heart. We then will close that chamber with suture, much like I would bedside or through a sternotomy or traditional open approaches.

The key to minimally invasive in my mind is that the techniques don't change. Utilize the same techniques you would, the same durable techniques you will, and that way we don't compromise on the long-term. These are the same exact techniques that I do through a sternotomy, that I do in minimally invasive.



#### **Robotic Post-Op Patient Pictures**



**Dr. Pavan Atluri:** These patients do very well with very limited incisions. Incisions are allowed to be a little bit smaller robotically because there's no visualization through the wound at all. It's simply just a port to be able to pass incisions through. You see a cadre of my patients were men and women. Again, we have not disrupted chest walls so at two weeks, I'll let them do anything. About a month before they can swim, I want to make sure the wounds actually heal over very nicely.



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#### **Post-Operative Recommendations**



**Dr. Pavan Atluri:** So usual post-op pathway, rapid extubation. Many of these patients are actually taken off the ventilator in the operating room if not very shortly thereafter. We're trying to get away from all narcotics. We use a combination of IV Tylenol, long-acting local anesthetic to do nerve blocks, and then Neurontin or gabapentin, a nerve agent. With that, up to 80, 90% of patients discharge post-op day three without any narcotics. At two weeks, you can do all activity. You may not feel like it because this is still major surgery but if you're up to it, I let patients play tennis; I let them play golf, certainly go back to work if they want. Then usual protocol at Penn Medicine is we do annual surveillance every year to keep an eye on the valve, just make sure everything looks good.



# Transcatheter Mitral Valve Repair (MitraClip)



**Dr. Pavan Atluri:** Just to briefly touch upon some experimental techniques and novel percutaneous techniques, transcatheter mitral valve repair has, of course, seen the advent of the <u>MitraClip</u> which has been approved for very high-risk scenarios. This is a clip which can reapproximate abnormal parts of the leaflet and then it's shown pretty good data in high-risk patients, in patients where they may not be candidates for surgery. We are cautious to low-risk patients because the results aren't quite as good as surgery. Sometimes we see mild, moderate degrees of regurgitation which could be troubling.



#### **Clinical Trials**



**Dr. Pavan Atluri:** There are certainly a whole cadre of various mitral valve repair and replacement technologies that are coming down the pipeline, many of which we have here at the University of Pennsylvania to utilize various techniques to either repair the valve or in a valve that's too diseased to replace the valve.

You see some of them listed here.



# **HARPOON Clinical Trial**



**Dr. Pavan Atluri:** A cool, new concept is to utilize a very small incision in the left chest, access the heart, and then utilize this device called the HARPOON to come across the apex of the heart, the tip of the heart, capture the abnormal part of the leaflet, and then pull that abnormal part down to reshape the leaflet.

We'll have to see long-term what the data looks like but the technology appears very promising. We're very excited to be a part of this trial.



# **Questions & Answers**



**Adam Pick:** Dr. Atluri and Dr. Szeto, thanks so much for the prepared remarks. I loved hearing about all the great things you were talking about when it comes to repair, the durability, the freedom from re-operation, the possibility of minimally invasive as long as it's safe and proven out.

We're going to get to our "Question and Answer" session now. We've got some great questions that came through. To start, I have a question for you both. We got a lot of patients on the line who might be getting ready for surgery. To start, Dr. Szeto, if I'm a patient and I may be preparing for getting an aortic valve repair, "What advice would you have for patients?"



**Dr. Wilson Szeto:** Thank you, Adam. I think that's a very important question. I want to just reassure everyone that it is a diagnosis that many patients encounter with. I think the key is do your homework. I think doing some research and getting accustomed to and understanding what that means for you. I think this we'll reassure you that it is something that we have very, very good treatment options for today in 2021.

Number two, I would listen to your care providers and understand where some of your best options are. I would focus and listen to your care providers to try to identify care providers that really have a team approach to how to best manage valve disease so that you have every option available. Discuss this, so that you can make an informed decision at the end of the process about your treatment options.

**Adam Pick:**Thanks, Dr. Szeto. Now moving over to Dr. Atluri, I know one of the questions patients might be thinking is, "Do all cardiac surgeons do mitral valve repair?"

**Dr. Pavan Atluri:** That's a great question, Adam. Unfortunately, if you look at the data, I think most heart surgeons do less than three mitral valve procedures, repairs and replacements put together per year. As with anything we do, volume matters. There's been a lot of studies that have looked at correlations between outcomes and volume. I think it's important to ask the questions. Do you feel comfortable? Is this something you do? Is this your expertise? Patients in the modern era – this isn't an era of doctor knows best always. This is one where it's a give-and-take, and we talk about it. I always tell patients I'll guide them through the decision process and you make the decisions. I can only tell you – share my knowledge and help you get there. It's really up to the patients to make that empowered decision.



Adam Pick: Let's get into the Q&A from the patients that came in.



Tony asks a question all about tricuspid valve repair. He asks, "I was diagnosed with severe mitral valve regurgitation and I'm in the process of planning surgery. My doctor mentioned that I may need to have a tricuspid valve repair in addition to mitral valve repair. Is this common? I didn't even know I had tricuspid valve leakage until recently."

**Dr. Pavan Atluri:** Tony, you're asking an excellent question; I wish I knew the answer. This is a question that we as heart surgeons have been tackling and as mitral valve surgeons we've been tackling. To start in reverse order, yes, it's very common to have tricuspid valve disease with mitral valve disease. Often times it will get better when you repair the mitral valve disease; we just don't know. There's two main ideas that we start thinking about, not always taking care or treating but thinking about when it comes to taking care of the tricuspid valve at the time of the mitral valve repair, and those are patients with severe tricuspid regurgitation but the valve itself is getting stretched. The magic numbers when we talk about 4 centimeters, a big valve, we start thinking about it. The data's very mixed and the answer's not very clear at this stage. It's a question that many of us tackle on a





regular basis.

Minimally Invasive Multi-Valve Operations Meart Valve Surgery.com Susan asks, "I've had successful minimally-invasive (right mini-thoracotomy) to repair my mitral valve. I found out recently that I have a ortic stenosis that may eventually require surgery. Is it possible to have minimally-invasive heart surgery twice or does scar tissue make it difficult or impossible for this re-entry?"

**Adam Pick:** Susan asks, "I've had a successful minimally invasive right minithoracotomy to repair my mitral valve. I found out recently that I have aortic stenosis that may eventually require surgery. Is it possible to have minimally invasive heart surgery twice or does scar tissue make it difficult or impossible for this reentry?"

**Dr. Wilson Szeto:** Susan, thank you for that question. It's an excellent question. This is scenario that is encountered by many patients such as you. The short answer is it is possible. Having said that and not knowing your medical background, there are certainly many potential options for a second intervention on your aortic valve for your aortic stenosis. Absolutely, it could be a second minimally invasive open heart surgery. The scar tissue may make it more difficult, but I think this is where it's important for you to identify a center of excellence with a strong heart team. Depending on your medical background, even less invasive procedures such as a transcatheter aortic valve replacement may also be an option for you. That would then allow you to avoid a second open heart operations. I would say the answer is yes, and I would say that you have more than one option to address your aortic stenosis when the time's





**Adam Pick:** Sonya asks, "Most of what I see on your website is about mitral, aortic, and tricuspid valves I have pulmonary valve regurgitation. Is it possible to get a pulmonary valve repair instead of a replacement?"

**Dr. Wilson Szeto:** Sonya, that's a great question. You're absolutely right; we do mostly on many media, social media, focus on mitral, aortic, and tricuspid. The reason for it is pulmonic valve regurgitation is not as common as regurgitation in the other three positions. In terms of work and options for repair, unfortunately today, there are not many viable or good, durable repair options or strategy. Replacement often is an option when indicated. There are advances made in replacement in aortic – in pulmonic position, excuse me, both for minimal invasive as well as catheter-based therapy. A catheter-based replacement of the pulmonic valve is now becoming more and more commonly performed.





#### **Mitral Valve Re-Repairs**

Grace asks, "After my mitral valve repair on 1/9/19, my valve in now moderate leaky. I have not gone for my TEE because I do not want to go into NYC at this time [due to COVID]. I do not have any major symptoms. But, I did not have them before my MVR neither. Would you please ask the doctors if re-repairs of the mitral valve are possible?"

**Adam Pick:** Grace asks, "After my mitral valve repair on January 9, 2019, my valve is now moderate leaky. I have not gone for my TEE because I do not want to go into New York City at this time [due to COVID]. I do not have any major symptoms. But I didn't have them before my MVR, either. Would you please ask the doctors if re-repairs of the mitral valve are possible?"

**Dr. Pavan Atluri:** Great question, Grace. The short answer is yes, they certainly are possible In fact, we've studied this as a pretty large mitral valve repair center, referral center. Occasionally we will see patients who've had prior mitral repairs with recurrent regurgitation. What we've found in our investigations and evaluation is that we can re-repair these valves. We can re-repair them safely with long-term durability. The other question that, of course, will arise with this is what is the timing and when is the appropriate timing. That's something you should really work with your practitioners on. It's very much a gray area. If it was mild, I'd say, of course, no reason for it. Severe it becomes very clear in terms of especially if you have symptoms to proceed. Moderate without symptoms is one where it's a little bit of a gray area, and it's worth having a conversation about the risks and benefits.





**Adam Pick:** John asks, "Can a porcine aortic valve be repaired? What does one do if a porcine aortic valve is wearing out?"

**Dr. Wilson Szeto:** John, excellent question. In general, when bioprosthetic valve fails or structural valve degeneration occurs, it is often quite challenging to repair a bioprosthetic. Number two, there's limited data regarding whether it's worthwhile, i.e. is it going to be a durable repair. Getting a little bit nuanced, depending on the reason for intervention, if there is a leak around the valve and the leaflets themselves are working, certainly, we can close that leak and retain the porcine valve, but in general, for most cases where the valve has structurally degenerated, the better option would be to re-replace that aortic valve.

Having said that, with new technology now, again, similar to that earlier question, it could be a open operation or a transcatheter-based placement of aortic valve, what we call a TAVR valve in valve. Again, not knowing your



background, that's a discussion that I would highly recommend that you go to your local center of excellence heart team to discuss all your options.

**Adam Pick:** Dr. Szeto, a quick follow-up. I'm assuming there's going to be a lot of patients on the phone who might have similar questions in their minds like John. Getting back to the valve in valve procedure, is that something that's regularly performed these days or is that still an experimental procedure?

**Dr. Wilson Szeto:** Great question. The TAVR valve in valve procedure, which is a catheter-based procedure through the groin without open-heart surgery, is an approved product or device with an approved label, so yes, now these patients can be treated like this, and it is becoming more and more commonly performed because the outcomes have been very, very promising at least in the short-term. As we get into younger patients, I think time will tell about durability, but at least in the short-term, these procedures have been very, very promising.





**Adam Pick:** Fantastic to hear. Thanks for all the work that you and your team there are doing on the TAVR solutions. I know you were one of the pioneers in some of the early trials. Let's move on to moderate leakage after mitral valve repair. I hear this across all valves, Vicki asks, "I had mitral valve repair, and they said I still have moderate leakage. Should I be alarmed? My left ventricle is enlarged from severe leakage. Will this moderate leakage add to the enlarged chamber?" Dr. Atluri?

**Dr. Pavan Atluri:** Vicki, this is a tough question. We traditionally don't like to have regurgitation following a valve repair. When we think about left ventricular enlargement, it's traditionally in the sense of severe leakage of severely regurgitant valve. It's hard to know what impact moderate leakage will have on the chamber. This is one where it's probably worth taking a look at your studies and seeing certainly what the trajectory is and doing some more sensitive measures as well on regurgitation. There may be a consideration for re-repair.



**Adam Pick:** Thanks, Dr. Atluri. Just as you can talk about mitral valve repair for hours and hours, I'm imagining from all the questions coming in, our community and the patients here could ask you questions for hours and hours. Unfortunately, we're getting to the end of the webinar. But please don't hang up just yet. I want to extend a tremendous thank you to all the patients, the family members, and the friends for making this such a special community event. Love having you here. Love learning together.

I'd also like to thank Dr. Atluri and Dr. Szeto for taking time away from their very busy practices at Penn Medicine to share their clinical experiences and your research with our community today. Again, I'm full of thanks. Thanks to everybody in our community, and thank you, Dr. Szeto and Dr. Atluri. Thanks for being here.

Dr. Pavan Atluri: Thank you, Adam. Thank you, community.

**Dr. Wilson Szeto:** Thank you, Adam, and thank you to you and heartvalvesurgery.com for all you do for our patients.





#### **Patient Resources**

Since 2006, <u>HeartValveSurgery.com</u> has developed several resources to help you better understand your diagnosis, your treatment options and your recovery.

Listed below, please find resources created exclusively for patients and caregivers. We hope they educate and empower you.

- <u>Adam's Free Patient eBooks</u> Download 10 free eBooks about heart valve disease and treatment options for aortic, mitral, pulmonary and tricuspid valves.
- <u>Heart Valve Learning Center</u> Visit the Heart Valve Learning Center to access over 1,000 pages of educational information about valvular disorders.
- <u>Patient Community</u> Meet people just like you in our patient community. There's nothing better than connecting and learning from patients who are sharing their stories in our community.
- <u>Surgeon Finder</u> Find and research patient-recommended heart surgeons that specialize in heart valve repair and heart valve replacement procedures.
- <u>Heart Hospitals</u> Learn about medical centers that have dedicated teams and resources that specialize in heart valve therapy.
- <u>Adam's Heart Valve Blog</u> Get the latest medical news and patient updates from our award-winning blog.
- <u>Educational Videos</u> Watch over 100 educational videos filmed by the Heart-ValveSurgery.com film crew about heart valve surgery.

