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## Modernizing the Mitral Valve: Advances in Robotic and Minimally Invasive Cardiac Repair

Narrator:

Welcome to “**Medical Breakthroughs**” from Penn Medicine, Advancing Medicine Through Precision Diagnostics and Novel Therapies.

Dr. Caudle:

What are the latest advances in minimally invasive and robotic operations, and which patients are candidates for robotic procedures? You're listening to ReachMD and I'm your host, Dr. Jennifer Caudle. And with me today is Dr. Pavan Atluri, Assistant Professor of Surgery. He is also the Director of the Cardiac Transplantation and Mechanical Circulatory Assist Program and he is the Director of the Minimally Invasive and Robotic Cardiac Surgery Program in the Division of Cardiovascular Surgery at the University of Pennsylvania. Dr. Atluri, welcome to the program.

Dr. Atluri:

Thank you and thank you for inviting me.

Dr. Caudle:

Well, we're happy to have you today. So, we're talking about minimally invasive and robotic operations. Can you tell us what the advantages of these procedures are?

Dr. Atluri:

Yes, I think there are several advantages; the first and probably the least important of which is cosmesis, but of course the incision is markedly smaller and allows people really to have the operation and postoperatively really be unrecognized from an operative standpoint, as opposed to the old days where there was a big scar down the middle of the chest. The other advantages really are in terms of recovery. It's a much more rapid recovery, and really, several of my patients will be ready to resume normal activities within a couple of weeks of surgery, and that includes going back to work and really partaking in their daily activities. So, it's been a really nice improvement in terms of how quickly patients bounce back from the operation.

Dr. Caudle:

That's interesting. Can you talk to us about really what's involved with a robotic operation?

Dr. Atluri:

I often get the question, what are you doing if the robot is doing the operation, which is always sort of an interesting question, but really speaking, the robot is an extension which allows us to work through some very small ports. There are two robotic arms which both go through a 7 mm port and then a very small limited working incision between 2 to 2.5 cm. The conduct of the operation involves the bedside surgeon who, my partner, whoever is at the operative side of the table, and then I'm working at the robot. The robot itself has got several advantages over the current laparoscopic or thoracoscopic operations in that it's got, first and foremost, it has 3-dimensional vision that takes 2 separate images; one that is "at the left eye and the other the right eye," merges it together to provide a 3-dimensional image within the console. And the second, is that it really provides the wrist and the finite motion back that disappears with straight-shafted instruments from traditional small-incision thoracoscopic surgery. So, really, it gives us a lot more precision and an ability to work through small spaces.

Dr. Caudle:

Oh, that's interesting. So with that, with that precision that you have and sort of the ability to almost take surgery to another level, sort of what you're describing, what procedures can be performed robotically?

Dr. Atluri:

Yes, there are actually several. The most common that we do is the robotic mitral valve operation and that includes both repairs as well as replacements. It can also involve repairs of holes in the heart or atrial septal defects. We've excised tumors from inside the heart. We can also operate on the tricuspid valve. Outside of the heart, we're able to do bypass surgery through small incisions and avoid the traditional sternotomy or zipper that goes along with the coronary artery bypass grafting procedure.

Dr. Caudle:

That's interesting. And how might you decide which surgeries you choose to perform robotically versus a different way? You know, are there certain criteria, or certain things that you think about, besides the cosmesis and recovery that you mentioned in the beginning?

Dr. Atluri:

Yes, absolutely. You know, at the end of the day, it always comes down to patient preference and I really try to spend a lot of time with patients, telling them the risks and benefits of the operation, really go through what's involved. And that first step is really for the patient to decide, hey, this is something I want to do, and then after that we go through a fairly extensive screening process to make sure that we avoid any of the pitfalls that may arise. And that may include a CAT scan to make sure there isn't too much calcium within the aorta that could cause complication, any possible risk factors for stroke; basically anything that we've learned over the last 1400 cases that we've done that could contribute to a problem.

Dr. Caudle:

Sure. Just out of curiosity, what is the cardiac procedure that you tend to perform most minimally invasively or robotically?

Dr. Atluri:

It's the mitral valve operation. Mitral valve repair procedure.

Dr. Caudle:

If you're just tuning in, you are listening to "Medical Breakthroughs" from Penn Medicine on ReachMD. I'm your host, Dr. Jennifer Caudle, and I'm speaking with Dr. Pavan Atluri, Director of Minimally Invasive and Robotic Cardiac Surgery Program at the University of Pennsylvania. So, let's go back a little bit. Let's take a step backwards, because we're talking about minimally invasive

and robotic procedures, especially as it relates to cardiac surgery. You mentioned a little bit about patient preference and patient candidacy. Can you speak a little bit more about which patients are candidates for robotic procedures and maybe talk a little more in depth about maybe who wouldn't be and who is, especially for some of the work that you do?

Dr. Atluri:

Yes, you know, I will say patients more often than not are, in fact, candidates for the procedure. There is a very small population of patients that are not well suited for robotic procedures and that would include, it really depends on the operation that's being performed, but for the coronary side of things, patients that have disease in several of the vessels in the heart, and the robot really allows us to get to the top of the heart and just to the side of the heart, so any time that we would need to do revascularization or provide blood flow to the other parts of the heart, we really tend to shy away from it if it's too extensive. If it's disease in two territories, we'll oftentimes do the robotic bypass surgery and then the additional territory is taken care of with an angioplasty or stent. But if there are too many territories involved, the last thing we want to do is leave someone with a small incision but not have the heart fully revascularized. So, that is one patient population. When we talk about the procedures within the heart, the ASD, the mitral valve, the tricuspid valve, or the tumors, then we really want to make sure that there isn't too much calcium within the aorta that would either lead to a stroke or a tearing of the aorta, known as a dissection. Both are very low incidences and extremely rare, but nonetheless something that we screen for, because if you are that extremely rare patient then it might as well be 100% certainty for you. So, we're very careful to make sure that we select those patients with heavy calcium burdens or atherosclerotic burdens and shy away from the procedure. And the other real big population is the patients that have extensive calcium, known as mitral annular calcification, around the mitral valve, and the patients are at significantly increased risk for something known as AV disruption or atrioventricular disruption. Literally the bottom ventricular portion of the heart separates from the top atrial portion. So, those patients really should not be treated minimally invasively and should really be treated with an open operation. And, in fact, those operations should really be performed at centers of mitral valve excellence, like the University of Pennsylvania by surgeons like myself, Mike Acker, Clark Hargrove, that are highly skilled and experienced in dealing with patients with that scenario.

Dr. Caudle:

You know, that was actually something I wanted to ask you, if you don't mind is, how common, the ability to do these procedures robotically or minimally invasively for the heart? Is this common throughout the country or is Penn sort of one of the unique centers that does these types of procedures?

Dr. Atluri:

We're fairly unique. I've got a lot of friends within the robotic community and I feel like I basically know everybody in the robotic community; it's such a small community. In talking to Intuitive, the company that actually supports the robot, I get a very clear sense of the number of people in the country that are doing robotic procedures, and it's a couple of dozen people around the country. So, it's a very limited operation.

Dr. Caudle:

Absolutely. It's very highly specialized. One of the things I wanted to ask specifically about is the mitral valve. So, maybe we can talk specifically about mitral valve repairs. You know, are mitral valves repaired with the same techniques robotically for example, as when performed with a sternotomy? Maybe you can speak about that in particular and contrast and compare.

Dr. Atluri:

We try to follow the same exact principles for repair because at the end of the day what we're really striving for is excellent longterm data. We don't want to perform a procedure through a small incision and compromise on the quality of the repair. So, when we perform a repair, first and foremost, we try to repair every valve. Our success rate is close to 100% at the University of Pennsylvania with valve repairs, which is significantly higher than the rest of the country. A lot of that comes from the experience that we have and a lot of it also comes for following appropriate principles for mitral valve repair. So, whether sternotomy or minimally invasively, we

follow the same exact procedure and techniques for repairing the valve. The other thing that we really strive for is really good longterm data, not just immediate repair, but really we want to get these patients out for their entire life. If they're 30 years old, we want to get them into their 80s or 90s.

Dr. Caudle:

Sure, of course, the success of the procedure is of utmost importance. Absolutely. I had a question about recovery time because that was sort of one of the things you mentioned in the beginning about some of the advantages to minimally invasive and robotic operations. Can you maybe give us an example of a cardiac procedure that might be done non-robotically or minimally invasive, versus one that is, and maybe the difference in recovery time or length of stay or what might be expected from the patient?

Dr. Atluri:

That's a great question. I just found out that one of our papers that we submitted was just accepted for publication and the premise behind the paper was really to ask that exact question is, what is the difference in length of stay?

Dr. Caudle:

Well, congratulations I should say.

Dr. Atluri:

Thank you. But it's about a day and a half shorter in terms of overall hospital length of stay. On average, patients stay about 4½ days after the minimally invasive mitral valve procedure, compared to about 6 days for the sternotomy procedure.

Dr. Caudle:

Is there a difference in complication rates that you've also noted, or were you not looking at that in this particular paper?

Dr. Atluri:

Yes, so complication rates are very similar and low for both, but the one major difference that we found is that there appears to be a lower tendency for blood transfusion, and along with that, anecdotally, we also notice much less bleeding with minimally invasive and robotic operations.

Dr. Caudle:

Absolutely. Well you know, it's really interesting and I think you really shed a lot of light on especially cardiac procedures and the advantages of minimally invasive and robotic operations. You know, is there anything else that you'd like to add today about these procedures and maybe the work that you do?

Dr. Atluri:

I would say, you know, it's new technology. I think it's important that, there are a lot of people that attempt it, and from a patient standpoint, it is very important to go to a center where there's really focus on the mitral valve in particular, and someone who's really got a lot of expertise in the mitral valve.

Dr. Caudle:

That makes a lot of sense. Dr. Atluri, thank you so much for being with us today and sharing your insights on, you know, robotic and minimally invasive mitral valve repair procedures, as well as other procedures.

Dr. Atluri:

Thank you.

Dr. Caudle:

I'm your host, Dr. Jennifer Caudle, and thank you so much for listening.

Narrator:

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