

Aortic Root Surgery

Announcer: Welcome to the Mayo Clinic Cardiovascular Continuing Medical Education podcast. Join us each week to discuss the most pressing topics in cardiology and gain valuable insights that can be directly applied to your practice.

Dr. Friedman - Hello, my name is Paul Friedman, I'm chair of the Department of Cardiovascular Medicine. And I have the great pleasure of being joined today by Dr. Gabor Bagameri, who is an assistant professor of surgery. Dr. Bagameri, thank you for joining me.

Dr. Bagameri - Thank you for the invitation.

Dr. Friedman - And today, we're gonna talk about aortic root disease and aortic root surgery, so let's start with the basics. What is the aortic root and what is the important anatomy of the aortic root as it refers to from a surgical perspective?

Dr. Bagameri - Well, thank you, it's an excellent first question. So the aortic root is the first part of your aorta that attaches to the base of your heart. And the aorta is the largest blood vessel in your body carrying all the fresh blood. It's shaped like a shepherd's hook and it attached to the aortas via fibrous tissue, it's called the aortic annulus. The first part of the aorta, the aortic root, has three gentle bulges, we call it the aortic sinuses. And it can give, two of the sinuses gives rise to that two main coronary artery which are supplying to the heart. And within the aortic root sits the aortic valve. And aortic valve, basically, it's a one-way valve. When the heart squeezes, it's allowing the blood to coming out of the left ventricle but it's preventing to going back into the heart.

Dr. Friedman - Who needs aortic root surgery, what are the diseases that impact the aortic root, and then what are the indications for aortic root surgery?

Dr. Bagameri - The most common indication for aortic root surgery when you have a weakening of the aortic wall, what we call aortic aneurysm. This aortic aneurysm can be isolated just to the aortic root but sometimes, it can also extend to the ascending aorta. And the reason to operate on the aortic aneurysm because the weakening, it can cause tear, what we call dissection, where eventually, it can lead to rupture, it can be life-threatening. So the most common indication is aortic aneurysm and the size where is depending on the patient factors and comorbidities when we are referring them to surgery.

Dr. Friedman - So how are these most commonly detected? How would a physician identify the presence of a thoracic aortic aneurysm?

Dr. Bagameri - I think the majority of incident or finding with the more frequent use of the CT and the MRI in the emergency room, it's most commonly the incidental finding, many of these patients, they are not even aware that they have an aneurysm. Sometimes, we call the aneurysm as a silent killer because it doesn't cause symptoms until it develops a tear or rupture. Sometimes also, the patient who have aneurysm, then we know that it can be hereditary, there is some genetic predisposition, so we start prophylactically screening family members. The symptoms, if it's a rapid growth or if the aneurysm gets really large size, like above six centimeter, it can cause some atypical chest pain radiating to the shoulder, to the back. Sometimes, if aneurysm gets quite big, can cause pressure on the surrounding structure, some breathing or swallowing difficulty.

Dr. Friedman - But for most people, it's asymptomatic, and they happen to see it maybe initially on a chest X-ray, which leads to a CT or an echo or an MRI. And what sizes are important and what size would you say, boy, this is, and I realize it's a function of comorbidity, so tell us a little bit more about that.

Dr. Bagameri - So the guidelines, the current guidelines for aortic root replacement or intervention are based on the size of the aneurysm plus other risk factors for aortic dissection. If you are, if you don't have any genetic predisposition or other risk factors like smoking or COPD, we call usually between 5 and 5.5 centimeter and we recommend elective repair. If you have a known genetic preposition, sometimes, it can be part of a syndromic like Marfan or Loeys-Dietz. The threshold is lower in Marfan disease, usually around five centimeter. If you have high risk factors like family history of previous rupture dissection, we lower it down to 4.5. And in certain genetic diseases like Loeys-Dietz, it gets to 4.2 centimeter. But in just in the sporadic incidental finding without any high risk factors, the surgical recommendation is between 5 and 5.5 centimeter based on the care team and the shared decision making.

Dr. Friedman - So suppose someone has an aneurysm, it's large enough where there's a worry that the risk of rupture is high enough that surgery is needed. Review with us what the different types of root replacement surgery are.

Dr. Bagameri - There are two main kind of aortic root replacement, the traditional, what we call the aortic root replacement, or the Bentall procedure, when we replace the aortic root and also we replace the valve. Sometimes, the valve can have hardening, calcification, or can be extremely leaky and the valve is not salvageable. In that case, we either use a mechanical valve or a tissue valve. Obviously, the mechanical valve, the advantage that is the durability is lifelong, but you have to take Coumadin or warfarin anticoagulation, and there's some inherent risks of bleeding or clot formation. With the tissue processes, you can theoretically come off the blood thinner, but there's a limited durability and I would say probably approximate between 8 and 10 years across the whole age population. The other option is the valve-sparing root replacement when we only replace the aortic root, but we are going to try to save the aortic valve. And this surgery especially is suitable for younger patient or people who otherwise have normal functioning valve and they want to avoid anticoagulation.

Dr. Friedman - In terms of valve sparing, they're also different types of valve sparing, do you wanna briefly comment on those? And how widely available are the valve sparing surgeries?

Dr. Bagameri - So there is two kind of valve sparing procedure, one is called the Yacoub procedure or the remodeling procedure, which is usually more suitable for older people without any non-genetic risk factors for aortic aneurysm, and it's very durable. The other is the David or the reimplantation technique. This is more commonly used, it's more widespread. It requires specialized training and experience, it's technically more demanding, but the long-term durability is excellent.

Dr. Friedman - And then what happens during aortic root replacement surgery, how's it done?

- Aortic root replacement is an open heart surgery. It requires a full sternotomy, we go on cardiopulmonary bypass, we stop the heart, and then we dissect the aorta, we cut out the coronary arteries, and depending on whether we do valve sparing or just regular aortic root replacement, we cut or save the valve. And then there is using a special graft, a Dacron graft, which is a polyester graft, and we're using that to recreate the aortic root and reimplanting the coronary arteries. And in case of a valve sparing procedure, we reimplant the valve itself within the Dacron graft.

Dr. Friedman - And advantages of this form of surgery as well as risks and complications?

Dr. Bagameri - So the advantage of the aortic root replacement is to prevent the sudden tear or rupture or dissection, which can be life-threatening. The risk with every major, it's a major surgery, there is some risk involved with the surgery, but 98 to 99% of people do well, so the mortality is, in our hands here at the Mayo Clinic, approximately 1 or 2%. The major, the other advantage of the valve sparing procedure, avoiding the use of the mechanical or bio prosthesis, that it decreasing the chance of the need of the Coumadin and the risk of thromboembolism from valve-related thromboembolism or the infective endocarditis.

Dr. Friedman - So once it's done, how long does it last? What is the survival of aortic root surgery?

Dr. Bagameri - Aortic root replacement in, when we use the mechanical valve, it's lifelong, hopefully, never going to need a repeat heart surgery, unless it gets infected, there is always a small risk, lifelong risk, and it needs certain prophylaxis, especially when you go into dentist, to prevent the seeding of the valve. So the Bentall procedure is extremely durable and the majority of the people, they don't need any reoperation. The valve sparing procedure, depending on the valve type, whether you have a tricuspid or a a bicuspid aortic valve. In a tricuspid aortic valve, if it's successful, especially in the end, there is only minimal regurgitation. The durability in the next 10 to 20 years is excellent, probably over 90%. In a bicuspid aortic valve, the results are

good in the short and the mid term, results are excellent. But there is a high rate of reintervention in the longer term after 10 years.

Dr. Friedman - And then what should the clinician be mindful of and what kind of follow-up do you recommend, if someone has had aortic root surgery, how often should their primary cardiologist see them? How often would you recommend imaging, what kind of imaging are you favoring these days?

Dr. Bagameri - So after the surgery, before discharge, we routinely perform an echocardiogram, a transthoracic echocardiogram, to assess the heart function and the success of the repair. And also we perform imaging user, it's a CTA, making sure that all the anastomosis are intact and there's no evidence of leak or pseudoaneurysm formation. Once we usually like to see the patient back in six months with the repeat imaging, just making sure there is no change in the short term, and once the six months follow-up is stable, meaning the echocardiogram and the CAT scan, then we repeat again in one year. And then probably can be tailored, avoiding, you know, the unnecessary imaging techniques, but probably every two to three years following up with echocardiogram and CTA or MRI.

Dr. Friedman - Now, suppose someone has aortic root surgery and then develops later degeneration or stenosis of the aortic valve, is TAVR an option, that is percutaneous valve replacement once that graft is in place, and what's the experience with that?

Dr. Bagameri - I think this is an excellent question because patients are frequent, they ask that. Once we did a, if you do a aortic root replacement with tissue valve, the TAVR is always an option because we already have a tissue prosthesis in place and it serves like a docking station, you can very easily put the valve in. When you do a valve sparing procedures, since we narrow down, we tighten up the aortic annulus, and there is two type of valve that, balloon-expandable, self-expandable, there is an option, the valve. It can be done, it's not officially approved for this application but definitely, it's an option. Or the other ways is to go and redo surgery, but most people try to avoid to redo open heart surgery if it's possible.

Dr. Friedman - Of course, one of the benefits of the surgery in the first place is, if additional valve work is needed, you potentially have the framework to support it.

Dr. Bagameri - Of course, yes.

Dr. Friedman - Yeah, yeah, great. Well, Dr. Bagameri, just a fascinating topic, and I really appreciate your sharing your time and expertise with us.

Dr. Bagameri - Thank you, thank you for the invitation.