

Melanie Cole, MS (Host): Welcome to the podcast series from the specialists at Penn Medicine. I'm Melanie Cole. And joining me today is Dr. Michael Ibrahim. He's the Director of Mitral and Reconstructive Valve Surgery at the University of Pennsylvania, and he's here to highlight the Ross procedure for us today.

Dr. Ibrahim, thank you so much for joining us today. Could you briefly describe the Ross procedure, its indications? Give us a little bit of an overview of the procedure and its significance in cardiac surgery.

Dr Michael Ibrahim: Sure. Thank you. So, the Ross procedure is a form of aortic valve replacement. It is used generally for younger patients, people who are fit and well, who have a life expectancy of 15 years or more. We use it in patients up to their 70s. It's an operation where the aortic valve is replaced with the pulmonary valve, which is the mirror image heart valve in the heart. And we replace the aortic valve with the pulmonary valve, and then we use a donated human valve from a patient that's passed away to replace the old pulmonary valve. And so, it results in two living valve replacements for patients that need aortic valve replacement.

Host: A fascinating procedure, doctor. It really is. And introduced in the '70s, as you described the procedure, it was performed for a time across the country, including at Penn, and then kind of disappeared. Do you know why this happened?

Dr Michael Ibrahim: As you said, it was first introduced in sort of the late '60s and early '70s and was used very widely initially because of good early results and really because of a lack of good alternatives. I think the problem was that a lot of surgeons around the country and around the world were doing it without really understanding several of the important technical points that are critical for its long-term success, and so there were problems.

I think in the small places where this has been continuously performed, there's been a real appreciation of the key technical points that are critical. And what has led to the resurgence of the Ross throughout the country and internationally is data, including some of our own, that has shown really outstanding results into the third decade with patients who have a Ross for 30 or 40 years with excellent results and with really outstanding survival. That's really incomparable to other valve replacement options. And I think now those technical points have been very well defined. The operation has been standardized. And it's no longer something that we don't fully understand. I think it's something we have a really good handle of what the ingredients are for a good long-term result.

Melanie Cole, MS: What does it offer that isn't found in other approaches to aortic valve replacement?

Dr Michael Ibrahim: So, I think there are two things that are really important with respect to that. One is the fundamental driver of the benefit of the Ross is that it's a living valve. You know, we often think of valves as these sort of passive flaps that allow blood flow in one direction, but they're really a lot more sophisticated than that. They have multiple cell types. They often open prior to the development of a

pressure gradient. And they're highly sophisticated with the ability to regenerate and repair and be resistant to infection. And all of the benefits of the Ross come from that fundamental difference.

Clinically that means that the Ross is the only operation which restores normal life expectancy in patients with both aortic stenosis and aortic regurgitation. It means that it is highly resistant to infection. It means that it provides a non-mechanical tissue valve option for patients that lasts probably upwards of 20 years. It means that for patients with very small hearts, that would normally get a very small prosthetic valve, you can put a valve that has a gradient that's very, very low in the single digits and critically doesn't change with exercise. So, there are some really unique advantages of the Ross operation that all derive from this fundamental biological superiority of being alive.

Host: Tell us about patient selection. How do you come to those determinants with patients? Speak about that shared decision-making and the possibility that they would have to look forward to a revision surgery at some point based on their age and comorbid conditions.

Dr Michael Ibrahim: For patients that are relatively young, I think the upper limit probably is 70 years of age, and who have a long life expectancy, and we're looking at the difference between what their life expectancy would be with a prosthetic heart valve versus a Ross. Those are really people that we're interested in offering this to, and we think it would help. There are some things that crop up in people's medical history that sometimes makes us pause, although it's very much a case-by-case based thing. But it's, as you mentioned, a shared decision between the patient and us, really understanding that this is a problem that will have to be dealt with over the course of their lifetime, the valve disease itself, and how the Ross can fit into that lifetime management of the valve.

You mentioned re-operation. It is true that patients may need a re-operation, as they get into their 20th or 30th year after surgery, but it's important to understand that re-operation is a much safer complication or price to pay for the operation, say, than bleeding with a mechanical valve or stroke. And so, we know that even with re-operation, patients tend to survive a longer period of time with a Ross and with other valve placement options.

Host: Doctor, I'd like you to expand for a second on what you just said, as far as mechanical valve replacement versus bioprosthetic versus the Ross procedure, switching out those valves. Quality of life is an issue here, right?

Dr Michael Ibrahim: One of the things that really attracts patients to mechanical heart valves is the idea that it's a one-strategy solution and that they will never need a re-operation. We know in fact that it's not true that patients never require re-operation after mechanical valves. And also, there are several restrictions in terms of blood thinners and their associated complications. And so, that's why patients are often interested in the Ross procedure.

In terms of quality of life after the Ross, I think there are two important points. One is that, in general, it's excellent. It offers the closest thing you can have to a natural normal aortic valve and people are able to exercise. There have been patients who've had Ross operations that have participated in the Olympics and other high-intensity sports.

But the other important point, is that the fundamental biological difference that drives quality of life is being alive and we know that survival is substantially higher after the Ross in the long-term than with other options. And I always bring it back to that, because that is a hard endpoint that is critical.

Host: Since the Ross isn't performed at many medical centers in the U.S. and isn't performed by many cardiac surgeons, what's needed at a medical center to support the introduction of the Ross procedure? How did you come by your interest in this procedure, doctor?

Dr Michael Ibrahim: I was lucky enough to train in my very early medical training and scientific training with one of the pioneers of the Ross procedure, Professor Yakoub in London, who did a randomized trial looking at the Ross compared to other root replacement options and has been an advocate for the operation for a long time and really provided incredibly strong data to support its use, and that was my inspiration to learn from him and others and sort of develop the Ross program here.

But I think you're right—that needs to fit into a wider, sophisticated valve center, which is doing regularly complex aortic root surgery, stentless roots, homografts and other complex valve and root operations. I think it's difficult to support a Ross program in isolation. And also, it's not just the surgeon or the surgical team even. It's cardiologists that are comfortable with doing echocardiography on the pulmonic valve and monitoring the Ross in the longterm, and so on. But that's sort of the basic element.

Host: This is absolutely a fascinating procedure and discussion here today, doctor. So, to summarize, let other providers know how a referring physician would reach out to you to discuss this procedure, and what you would like them to know about your outcomes at Penn Medicine.

Dr Michael Ibrahim: We are very happy to be able to provide this new operation--well, new to the region-- to our patients. We think it's a great tool for patients who have potentially a lot of life to get back to and to live. I would say if you're thinking about a patient that's relatively young that may need aortic valve replacement, then consider the Ross. And we're always happy to provide an opinion on the suitability of patients for a Ross. You know, I think my office details are out there, and we're always happy to see patients at any time to sort of connect.

Host: Thank you so much, doctor, for such an interesting conversation and for sharing your incredible expertise with us today. To refer your patient to Dr. Ibrahim at Penn Medicine, please call our 24/7 provider only line at 877-937-PENN. Or you can submit your referral via our secure online referral form by visiting our website at

pennmedicine.org/referyourpatient. That concludes this episode from the specialists at Penn Medicine. Please always remember to subscribe, rate, and review this podcast and all the other Penn Medicine podcasts. I'm Melanie Cole.