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Key Words: pulmonary valve, bioprosthesis, heart defects, congenital, pulmonary regurgitation, pulmonary stenosis, reoperation, pediatric

Discussion

Presenter: Dr Mariana Chavez

Dr James A. Quintessenza *(Lexington, Ky)*. Congratulations on an excellent, clear presentation with a lot of data. I appreciate receiving the manuscript in advance. This report is on twelve hundred seventy-eight patients younger than the age of 30 years undergoing pulmonary valve replacement. It's a multicenter retrospective review, and it's consistent with other reports in the literature.

We saw in the performance of these valves that all bioprostheses will degenerate over time, and more so in younger patients. The performance of the Sorin, the Mitroflow, and the St Jude valve seem to be worse. In addition, the second-generation PERIMOUNT and the third-generation Magna valves were not much different, suggesting that we haven't made a lot of progress in terms of preventing degeneration in these newer valves. The overall take-home message, I think, is that we still have a lot of work to do regarding durability for our patients.

My interventional colleagues tell me that transcatheter valves and stents don't seem to degenerate. There may be some improvement with those types of transcatheter approaches, and I think time will tell us. Possibly, newer biomaterials, synthetic materials such as expanded polytetrafluoroethylene or newer mechanical valves coupled with improved methods to modulate the coagulation system will provide some better outcomes as well.

We will see, but for now, we have what we have. I just have a few questions really to clarify some of the points you made. In the multivariable analysis, both younger age as well as small valve size were independent risk factors for early degeneration. Can we assume that it wasn't just smaller valves in younger children that simply failed due to outgrowth, but there is something else operative in the interaction of these valves in younger patients, which leads to more rapid decline?

Dr Mariana Chavez *(Boston, Mass)*. Thank you for your question. We didn't look at other variables such as genetics or any other thing that could influence the reintervention, but we do take into account that smaller patients eventually outgrow their valves. So that's why we need to replace it. All these valves were not necessarily replaced because they failed, but because the patient outgrew them, so it is important for us to take into account that these children have congenital heart disease and they may have associated diseases.

We didn't look into other factors specifically for genetic diseases or concomitant disease.

Dr Quintessenza. In previous reports, longevity of right ventricular outflow tract reconstruction using the native outflow tract seemed to be an advantage and you didn't find that in this analysis. Do you think that difference might be due to the use of homographs versus heterografts, in terms of creating extra-anatomic versus native outflow tracks? We might ask Chris to help you.

Dr Christopher W. Baird *(Boston, Mass)*. So it sounds like the question is: the angle of the valve and the way the valve sits in either the native outflow tract or extra-anatomic, is there a difference in this study? We didn't show any difference. However, based on our experience, we've seen that in patients with pulmonary atresia where their valves tend to fail quicker. I think we weren't able to tease that out in this study. So I don't think we can really address that.

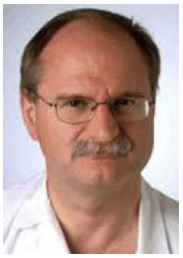
Dr Quintessenza. One more question: In the manuscript, larger valve sizes and a smaller valve size to body surface area protects against earlier intervention. That seems to imply that putting in a bigger valve is good up to a certain point, but if you oversize, you start going in the other direction. Do you have an optimal valve size to body surface area or z value that you would recommend for valve implantation?

Dr Baird. That is a difficult question. As everyone knows, every valve has a different external diameter in relation to its internal diameter. So, the problem becomes when you break down each individual valve and you compare the external and internal diameters, they're different. So you have to take a ratio of those—and every valve was different. Thus,

in a study that has multiple valve sizes and multiple types, it's difficult. The ideal valve size out of all these valves was like a 23, among all patients, but that's hard to extrapolate.

Dr John W. Brown *(Indianapolis, Ind)*. Enjoyed this study. Is the takeaway message that porcine valves in the pulmonary position are more durable than pericardial valves in the pulmonary position? I just tried to look at the graphs; it seemed to me that the porcine valves were lasting longer. Is that a misinterpretation of the data?

Dr Baird. I don't think it's a misinterpretation of the data. The problem is that there was a limited number of porcine valves in the entire series. So I think our sense is: yes, porcine valves did better in younger patients, but it was skewed toward porcine valves going in younger patients.



Dr Antonio F. Corno *(Leicester, United Kingdom)*. It seems that the malfunctioning of the valve implanted in the pulmonary position is due mostly to platelet deposition on the leaflets. Were the patients in your study treated with antiplatelet treatment in all the centers, and for how long? Thank you.

Dr Chavez. We did not take into account how long the patient was on antiplatelets, but we did record if they were on aspirin, on Coumadin, or a combination, and in our univariate analysis; there was no significant risk to being only on aspirin or a combination.

Dr Damien J. LaPar *(New York, NY)*. Great presentation. Regarding the question of porcine and pericardial valves, as congenital surgeons, we are at the mercy of industry. We are using valves created for aortic valve disease in adults for pulmonary valve replacement. And porcine valves versus pericardial valves—pericardial valves actually have a greater opening pressure. It's negligible; it's like 4 mm of mercury versus 2 mm of mercury. For that reason, I don't know if that has an impact on longevity, but I think it's a little tough to tease out your conclusion that pericardial valves are superior to porcine valves. Is that a pretty solid finding?

Dr Baird. That is a very important point but that wasn't one of our ultimate conclusions. It was a finding of the data we had. The problem is that we had a limited number of porcine valves, and they were in primarily younger patients. I think what we can say is: based on this data set, porcine valves were better in younger patients. So we can't make that general statement among older patients because we didn't have very many porcine valves in older patients.

Dr LaPar. Just one question to add: Did the porcine valves in the younger patients have Hancock conduits?

Dr Baird. Yes, a portion of them.

Unidentified speaker. Chris, that study shows what we all know, and the cardiologists are telling us, that in the first 5 years, the bioprosthetic valves are going to do well, then they'll start failing, and then after 8 to 13 years you'll need to do a reintervention. And I was taught never to put a homograft, except that decellularized homograft in other conditions in the Ross operation, for example, now can last 15 to 20 years, and they'll have an easier transcatheter valve insertion. So, do you think we should change what we were all taught and never put homographs in the native outflow, because you can put them in the annulus of the pulmonary valve and put on the patch, and leave them in an anatomic position. So do you think this is the message?

Dr Baird. Let's just take a poll of hands in the room, since Carl's here. I'm not sure that's true. How many folks put homographs in the pulmonary position to replace the pulmonary valve? So not everyone puts bioprosthetic, and certainly if Tom Spray was here—I think he used to put homographs in the pulmonary valve position in older patients. So I don't think we can jump to that conclusion, but this study certainly does not address that.

Unidentified speaker. I'm a valve engineer, so this comes from a valve designer standpoint. We all know that every valve design is different. My first question is: Does all this reintervention stem primarily from structural valve deterioration? Second, are all the failure modes the same? As compared with a standard valve, failure in a porcine valve may be more due to calcification and the pericardial valve may be more due to pannus ingrowth.

Dr Chavez. For your first question, not all of the reinterventions were due to valve failure. Some were due to the patients outgrowing their valve. Dr Baird will take the second question.

Dr Baird. We can't answer that question adequately with this study. This study is a large multicenter study and looked at reintervention. It didn't look at mechanism of failure. But what we can tell is it the patients who failed had predominantly pulmonary stenosis going into the valve replacement. I think a really important point that wasn't brought up here was the anticoagulation strategy. I think that's really fundamental, and I think folks are doing things very differently with regards to that now.

Our current anticoagulation strategy is aspirin and Coumadin for 3 months, but you may want to comment on your strategy.

Dr Corno. What we are seeing (we use only porcine valve) is the reduction of the leaflets' movements due to platelet deposition. That's why I previously asked how long in your study the aspirin had been given. We give aspirin always for 3 months now; should we move to a much longer period if it's true and proven that it is platelet deposition reducing the leaflets' movement?