Transcatheter Aortic Valve Implantation (TAVI) vs Aortic Valve Replacement (AVR): Patient Selection

Moderator
Jeffrey J. Popma, MD
Director
Innovations in Interventional Cardiology
Beth Israel Deaconess Medical Center
Associate Professor of Medicine
Harvard Medical School
Boston, Massachusetts

Panelist
Mathew R. Williams, MD
Surgical Director
Cardiovascular Transcatheter Therapies
New York-Presbyterian Hospital
Columbia University Medical Center
New York, NY

Slide 1

Jeffrey J. Popma, MD: Hi. I'm Dr. Jeffrey Popma, Associate Professor of Medicine at Harvard Medical School and Director of Innovations in Interventional Cardiology at the Beth Israel Deaconess Medical Center in Boston. Our Spotlight today will focus on selecting patients for transcatheter aortic valve implantation.

I'm joined by a Cardiovascular Surgeon of renowned expertise, Dr. Mathew Williams, Surgical Director of Cardiovascular Transcatheter Therapies at New York Presbyterian Hospital and Columbia Medical Center.

Mat, it has been a wild meeting so far at TCT [Transcatheter Cardiovascular Therapeutics].

Mathew R. Williams, MD: It certainly has.

Dr. Popma: I think this is actually one of those very unique opportunities, at least for me in this field, where cardiac surgeons and interventional cardiologists are together in the same room; they're getting along, they're discussing patient selection, and the idea is that they're both sorting out what therapies are optimal for patients.

Dr. Williams: I agree. We really are seeing a collaborative atmosphere now. It's not the CABG/PCI [coronary artery bypass graft surgery/percutaneous coronary intervention] of the past. I think we're all accepting that this technology is going to be part of our future, and we're working together to really advance it.
Dr. Popma: I have to say that there are definitely still some personalities in both of our professions. We spent Saturday together at the VARC [Valvular Academic Research Consortium] meeting that was coordinated by Marty Leon, Patrick Serruys, and Don Cutlip talking about endpoints. We were joined by very senior and experienced surgeons and interventional cardiologists.
What I was struck with at that meeting was a very sobering, but realistic look at our current risk stratification models for assessing patient risk, both with respect to the logistic EuroSCORE [European system for cardiac operative risk evaluation], which has traditionally been used by the European surgeons and the STS [Society of Thoracic Surgeons], which has been validated and used, in extremely large numbers of patients, to come up with predicted morbidity and mortalities. I was struck by a couple of different pieces, and I'd like to get your perspective about it.
We know that the EuroSCORE overestimates risk, but in the higher-risk patients, we know that the STS score underestimates the observed risk. As a surgeon, how do you use these scores in your practice and what should we be doing for aortic valve therapy?

Dr. Williams: To be quite honest, I really wasn't using them before. It's probably like a lot of other specialties, where you have an understanding of the data to some degree, and it's really hard to say what goes into all the decision making. As you know, everybody talks about the eyeball test, and it's something that is not concrete, and you can't really define it, but there are factors just from seeing somebody. You can have patients who are the same age and have the same general risk factors, but one of them looks great and one of them doesn't, so you really estimate the mortality. These risk scores are, obviously, very hotly debated. Just from the onset of all of these trials, it's been something we've really had a hard time understanding. I think it is important because we do have to have some kind of objective criteria, and these risk scores are very good for that, and we should probably accept them for allowing an entry barrier into these high-risk trials, but also understand that the absolute values themselves are not predictive.
Fried Frailty Index

Fried Phenotype of Frailty

<table>
<thead>
<tr>
<th>Weight Loss (unintentional)</th>
<th>&gt; 10 lb in last year</th>
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<tbody>
<tr>
<td>Grip Strength</td>
<td>Lowest 20% by gender/BMI</td>
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<tr>
<td>Exhaustion</td>
<td>Self-report</td>
</tr>
<tr>
<td>Walk Time, 15 Feet</td>
<td>Lowest 20% by gender/height</td>
</tr>
<tr>
<td>Low Activity</td>
<td>Males &lt; 383 kcal/week, Females: &lt; 270 kcal/week</td>
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Frailty: ≥ 3 criteria
Intermediate/prefrail: 1 or 2 criteria

Dr. Popma: At the VARC meeting, this was one of my early exposures on a one-on-one basis with very senior surgeons in the group with respect to expertise. One of the things that Mike Mack emphasized, and Craig Miller and Craig Smith also emphasized, was that many of the factors that really determine mortality after aortic valve replacement are simply not collected in any of the current database scores. Craig Smith went through a very detailed discussion about frailty indices. What you've described as an eyeball test, we'd like to have something a bit more quantitative; what are you using at Columbia to sort out frailty? I understand that you have some specific indices that patients can or can't do to give you more objective evidence of what their frailty is.
Dr. Williams: Right, so there's a number of different tests, and I don't think we have any data to say what the best thing is, but there are simple tests such as grip strength. Rather than doing a 6-minute walk test, you can give them a very short distance and see how long it takes them to walk that distance. I would say that we're doing this now to collect the data, but at this point, we don't understand enough, so we're not using it to account for the risk model.

Dr. Popma: There was also another fabulous talk yesterday by Dr. Robert Guyton. He went through some of those very simplistic stratifications of risk for a 90-year-old patient who's thin but dancing, and this is very different than an 85-year-old patient who is very weak and comes to your office in a wheelchair. Do you make that assessment when you're sorting out how much their comorbidities are going to contribute to their 1- or 2-year mortality, and how much is the aortic stenosis going to contribute to their 1-year mortality? Understanding that you can fix the aortic stenosis in some of these patients with a valve replacement, either percutaneous or surgical, but you cannot really change their prognosis. What factors go into that for you?

Dr. Williams: That's really the big question, because we know a lot of these patients, even if they didn't have aortic stenosis, that their 1-year prognosis is quite poor anyway, and it probably doesn't matter what we're going to do. Similarly, for the patient who's in the wheelchair that's not always just related to the aortic stenosis, but there are also implications for them recovering from the procedure even more so if they had a sternotomy; it also applies if they're having any other kind of treatment.

Dr. Popma: But this is a lesson for us too, on the interventionalist side, with percutaneous
valves. If we're not treating the disease, we certainly can't fix the comorbidities. One of the things that we are looking forward to in the United States is, who among those patients deemed inoperable would be a candidate for percutaneous therapy, but I think we have to be very careful about this and ask ourselves are we really going to change their prognosis.

PARTNER: Inclusion Criteria

Cohort A and B
- Echo:
  - Mean gradient > 40 mm Hg or
  - Jet velocity > 4.0 m/sec or
  - Initial aortic valve area of < 0.8 cm²
  - Symptomatic (≥ NYHA Class II)

Cohort A (TAVI vs AVR)
- Predicted operative mortality ≥ 15% and/or STS score ≥ 10

Cohort B (Inoperable: TAVI vs Medical)
- Probability of death or serious, irreversible morbidity > 50%

Dr. Williams: Right. Obviously now, we're also limited by the inclusion criteria for the study and as well as what the US Food and Drug Administration is mandating. So what we're looking at now is very different than what we'll be doing in 5 or 10 years from now, especially if these devices get approved in the United States, and also taking into account what is being done in Europe now.

Dr. Popma: Another one of the areas that make surgeons feel the patients might be inoperable are porcelain aortas. Now that we have CT [computed tomography] angios, we're better at making the diagnosis of porcelain aortas; it's not such a bad thing for us to treat percutaneously if we can gain access to the valve itself. There are other alternative techniques that have been used for porcelain aortas, such as the apicoaortic conduits that have been done. What's your approach to the patient with the porcelain aorta?
Porcelain Aorta

Calcification
• Aortic root to arch

Risks of cross-clamping
• Embolism
• Dissection

Possible alternatives
• Apicoaortic conduits

Dr. Williams: The first thing is actually just defining the porcelain aorta; there’s not always agreement with that. I think a true porcelain aorta really goes from the aortic root up into the arch, and it’s a patient who you’re unable to put a cross-clamp on or cannulate. That being said, there are approaches for still trying to address this surgically, but it's certainly much higher risk, and it's something that if in the unlikely event you had a 50-year-old patient with it, you’d probably try, but in someone who's 85 with prior surgery and such, I think it really is not operative. I absolutely agree with you that it's a great indication for the percutaneous approach. I certainly don't know any of the data nor does anybody, but I think that transcatheter valves are a perfect solution to this problem. In patients who were unable to get into the trial for various reasons, we will do apicoaortic conduits. I think it’s a good option in these patients. It's certainly better than a short-term valvuloplasty.

Dr. Popma: Now there are a couple of comorbidities that are going to affect you more than us, but I think they're going to affect us as well. I'm going to ask about criteria with respect to underlying lung disease, obstructive pulmonary disease, and pulmonary function testing. When we're evaluating patients for percutaneous valve therapy, do you have a cutoff that you think about for surgical operability with respect to pulmonary function testing?
Dr. Williams: There are people who do have absolute cutoffs. The most commonly quoted one is an FEV₁ [Forced expiratory volume in 1 second] less than 1 L. I like to look at the percentage predicted, obviously because there are size variations, and usually we'll say about less than 50% or sometimes less than 40%. But as you know, in these patients with heart failure, it's hard to interpret their PFTs [pulmonary function tests] because that contributes, so we like to get them as tuned up as we can, and we'll take other factors into consideration. But certainly, a normal-sized person with an FEV₁ of 0.6 L or close to that, that is someone who we would absolutely call a nonoperative patient.

Dr. Popma: There are probably some other deal breakers like Home O₂ or CO₂ retention or other things.

Dr. Williams: Sure. Home O₂ is also difficult because there are usually a lot of patients who have carried a diagnosis of COPD [chronic obstructive pulmonary disease] for quite awhile, and they will start getting worse. So they're placed on oxygen for their COPD when, in fact, sometimes it's progression of the aortic stenosis. Also the pulmonary fibrosis patients, I actually think those are the people who really do the worst, at least with surgery, they really don't tolerate any kind of altering their respiratory dynamics.
Pulmonary Function

Typical cut off
- $\text{FEV}_1 < 1 \text{ L}$
- Varies with size
- $< 50\%$ or $< 40\%$ of predicted

Normal-size patient
- $\text{FEV}_1 < 0.6 \text{ L}$ inoperable

Home $\text{O}_2$
- May be related to aortic stenosis

$\text{FEV}_1 =$ Forced expiratory volume in 1 second

Dr. Popma: What about liver function tests, it’s been an important predictor for mortality and bleeding complication rates, what do you use in general for your criteria for liver function testing?
C-P Score > 7 had 86% sensitivity and 92% specificity for predicting mortality

Dr. Williams: Usually I'll rely on our hepatologist to help me stratify that risk, but it's something that is difficult for us because it's not in these risk scores. Somebody who's a Child class C cirrhotic could have an STS of 2% and that's someone who we know is not going to do well.

Your colleague in the trial had a very good study looking at how patients do after surgery based on their Child's classifications. The Child's C patients, they're not going to do well, whereas Child's B adds at least a 20% mortality to the procedure. It's doable, but it adds significant risk.

Dr. Popma: Now prior bypass surgery and LIMAs [left internal mammary artery] and RIMAs [right internal mammary artery] are also used as relative contraindications, particularly if those are functioning. Is that an absolute contraindication for you or a relative contraindication depending on what you have to deal with?

Dr. Williams: I think it's never an absolute contraindication. One of the issues that people have raised as a potential contraindication is if someone has a pedicled RIMA that crosses the midline to go to the LAD [left anterior descending artery] and you have to go right through the middle there. I still don't think that's a contraindication. It definitely adds risk, there's no issue about that, but the patients are revascularized, it's not an issue. In fact, when I tend to do them, I don't even isolate the mammary and just let the heart be profused during the case.

Dr. Popma: Is any age number an absolute contraindication to surgery?
Dr. Williams: I don't think so. That's a big reason why we see patients for this because the primary care physicians say, "Oh, you're 90 years old. The oldest patient I did surgery on was 98, and she had coronary disease also, so we had to operate. And she's driving around somewhere right now as far as I know, and yet there are 68-year-old patients who you wouldn't come near.

Dr. Popma: There are a lot of general cardiologists and internists that would like to know if their patients would be candidates, I get e-mails about this all the time. What's the best way to evaluate whether someone is a candidate for percutaneous therapy? Do they see you first? Do they see you with the interventionalists first, or do you guys have a combined aortic valve clinic or a valve clinic where you guys see them together and give them a single message as things move forward?
### PARTNER Trial: Key Exclusions

- AMI ≤ 30 days
- Aortic valve is unicuspid, bicuspid, or noncalcified
- SCr > 3.0 mg/dL or dialysis
- LVEF < 20%
- Aortic annulus < 17 mm or > 25 mm
- Any cardiac procedure (except BAV) within 30 days (or DES within 6 months)
- Severe AR or MR (> 3+) or prosthetic valve
- Untreated CAD requiring revascularization
- Hemodynamic instability
- CVA or a TIA within 6 months
- Life expectancy < 12 months
- Aortic aneurysm or severe iliofemoral disease
- Upper GI bleed within 3 months

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**Dr. Williams:** We will initially, because again, we're confined by some of the inclusion criteria. If there's something very clear, a 95-year-old patient with metastatic cancer, trached in an ICU [intensive care unit], those kinds of patients we'll rule out right away, or similarly a 65-year-old with no comorbidities, but otherwise we will evaluate the patient. I think that's a big part of it. In some of the studies, the protocol dictates what we obviously have to do at our institution. Then we will see them together. We don't have a defined clinic per se, though some of the sites have been able to do that quite successfully, but we will make sure that someone from the surgery and interventional team see the patient.

**Dr. Popma:** But it's a combined decision. From the patient's perspective, you don't give them a recommendation, and then they go see their interventionalist, and they give a recommendation. The key to this piece is, everybody talks together and then a single recommendation is made back to the patient.

**Dr. Williams:** Absolutely.

**Dr. Popma:** Now I wanted to just finish with just one thing that I'm just dying to know as an interventionalist cardiologist. Are surgeons trying to takeover our business? *Editor's note: Speaker is being facetious when asking this past question.*

**Dr. Williams:** It depends if you're going to train us or not. I don't think so, but at this meeting we're seeing a lot more involvement with surgeons now. As you saw at the VARC and even at the valve sessions yesterday, it's becoming a more collaborative environment. I think they want...
and should be involved, but the nice thing is the common message, that it needs to be together. I've done a number of transfemoral cases, and our interventionalists have done transapical cases, and I could probably do a case without them, but I don't think there's a reason to and vice versa.

Collaboration Is Key

Dr. Popma: It actually is a blast because I think what we're doing now at the Beth Israel Deaconess is we have a very good collaboration with our cardiac surgeons, Kamal Khabbaz and his team. What we're doing now is thinking out of the box, so we're doing thorascopic takedowns and a LIMA along with hybrid procedures for drug-eluting stents or talking about minimally invasive aortic valve replacement with concomitant PCI in the operating suite just before. John Byrne and David Zhou have really pushed this at Vanderbilt, as have others, and I think that the very strong message to patients is, that if we get along really well, maybe we can come up with therapies that are going to be particularly suited for the patients.

Dr. Williams: Yeah, I think when you combine some of these like you were saying with the hybrids, I would much rather have a LIMA in my LAD, but I would take a drug-eluting stent over a vein graft or a radial or anything like that. We're coming up with unique approaches to common problems and some unique pathologies, and you guys have much better toys too.

Dr. Popma: Well listen, we've got that part recorded, that you'd rather have drug-eluting stents in your noncoronary vessels, so we've got that recorded. Mat, I'd like to thank you for joining me, and I hope that you enjoyed this program.