Atrium Health
Sanger Heart & Vascular Institute

Lifetime Management: Why the First Valve Matters

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Why should understanding Valve Choice be important to Administrators?

- There are different TAVR platforms which are different in design and have different characteristics.
  - TAVR devices are not interchangeable and are not a commodity
- Physicians may select different platforms for specific anatomies and patient profiles
- Understanding why we make those decisions is important because valve choice and valve utilization mix can affect contracting and outcomes
- A highly functional Heart Team should include Administrators so that financial viability of the program is maintained and decisions are transparent

It's not just what valve first, it's also when
Early intervention should be the goal

- Severe Aortic Stenosis (AS) should be treated before symptoms onset
- The EARLY TAVR trial showed reduced unplanned hospitalization for acute symptoms
- NCD now covers TAVR for asymptomatic severe AS
- Elective TAVR has a lower LOS and allow for predictable scheduling
- ***Every acute AS hospitalization represents a missed opportunity that has consequences to patients and hospital systems***

What the First Valve Decides

What we know

- Patients may need multiple valves over their lifetime and need is expected to increase
- The first implant decides whether the next is catheter-based or surgical
- Index valve size and position drive future coronary access
- Reintervention rates rise beyond five years

The cost of choosing poorly

- Under-expansion and mismatch leave higher gradients to manage later
- An unfavorable frame can rule out a catheter-based redo entirely
- Compromised coronary access forces limits intervention options
- Explant adds bypass, ICU time, longer stay, and higher cost

The Case for Earlier Intervention

Better Outcomes

- Treatment before irreversible cardiac damage
- Fewer unplanned CV hospitalizations
- More cases done electively, not urgently
- Healthier patients for future reintervention

Lower Cost

- Fewer emergency admissions and ICU days
- Predictable, schedulable case volume
- Shorter stays and lower readmission risk
- Better throughput per cath lab day

How do clinicians pick the first valve?

- Annular characteristics
- Hemodynamics / Risk of Patient Prosthetic Mismatch
- Coronary access
- Risk of coronary occlusion
- Repeatability
  - Valve in Valve Considerations
- Durability
- Risk of need for pacemaker

The Economics of the Second Procedure

Redo TAVR

- Catheter-based in the cath lab or hybrid room
- Shorter stay and faster recovery
- Depends on index valve design and position
- Preserves the lower-cost pathway

Surgical Explant

- Sternotomy and cardiopulmonary bypass
- ICU time, longer stay, and extended recovery
- Higher staffing, supply, and facility resource intensity
- Greater cost exposure and readmission risk

Annular Characteristics

- Most anatomy is amenable to TAVR
- Infrequently patients may have adverse annular features
- Eccentric annular calcification risks annular rupture or PVL
  - This anatomy favors SAVR but for poor surgical candidates, Self Expanding platforms have a lower risk of annular rupture
- Heavily calcified leaflets and bicuspid valves with calcified raphe risk under expansion
  - This anatomy may also favor SAVR, but for poor surgical candidates, balloon expandable given its higher radial force is preferred

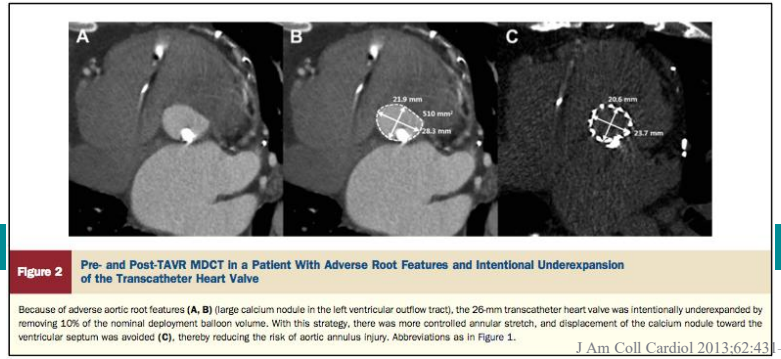
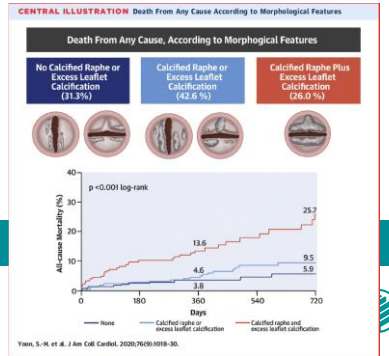


Figure 2 Pre- and Post-TAVR MDCT in a Patient With Adverse Root Features and Intentional Underexpansion of the Transcatheter Heart Valve

Because of adverse aortic root features **(A, B)** (large calcium nodule in the left ventricular outflow tract), the 26-mm transcatheter heart valve was intentionally underexpanded by removing 10% of the nominal deployment balloon volume. With this strategy, there was more controlled annular stretch, and displacement of the calcium nodule toward the ventricular septum was avoided **(C)**, thereby reducing the risk of aortic annulus injury. Abbreviations as in Figure 1.

J Am Coll Cardiol 2013;62:431–8

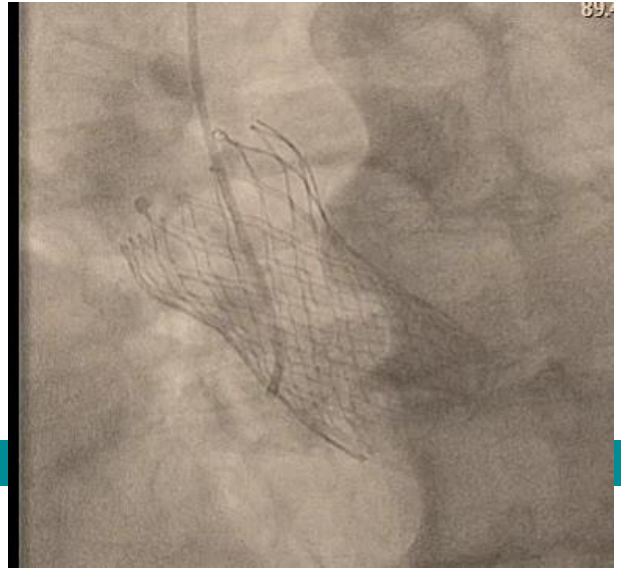


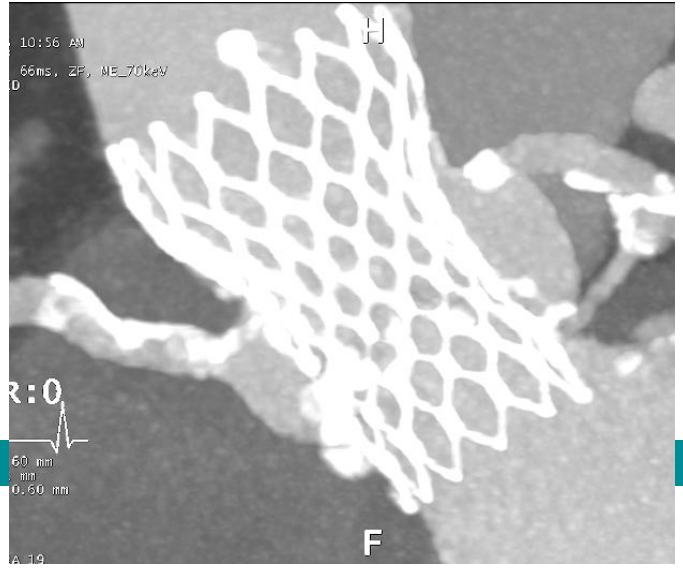
Hemodynamics / Risk of Patient Prosthetic Mismatch

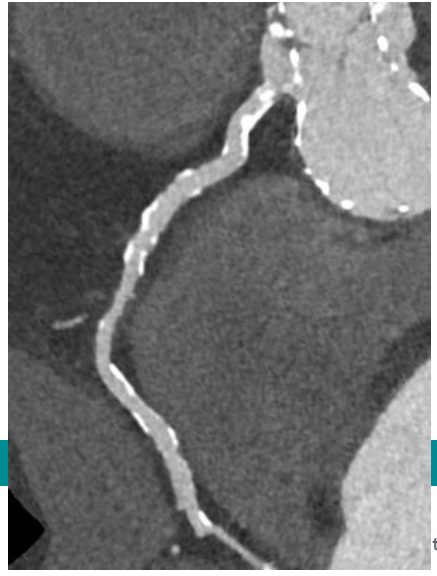
- Small annular area risks patient prosthetic mismatch
- Super-annular Self Expanding platforms may have larger opening and lower gradients
- This may translate into clinical benefits but is controversial given complexities of measurement of gradients
- For patients at greatest risk for patient prosthetic mismatch (very small annular area with larger patient) clinicians may select a SE platform

Coronary access

- Self expanding frames sit above the coronary ostia and make future coronary angiography challenging or sometimes impossible
- **For patients with coronary artery disease, a smaller frame valve is preferred to allow easier coronary access for PCI**







Risk of Coronary Occlusion

- Patients with low coronary height and effaced coronary sinus are at risk of acute coronary occlusion with TAVR
- For patients at risk, SAVR is preferred given ability to remove leaflets if acceptable risk
- Surgical and TAVR valve leaflets can also pose risk for coronary occlusion with “valve in Valve” procedures (TAVR in SAVR and TAVR in TAVR)
- This is more common and get at “Repeatability”

Valve Design and Coronary Access: Frame Height Matters

Taller frame
Self-expanding, supra-annular design

- Tall frame extends above the coronary ostia and sinotubular junction
- Leaflets sit above the annulus, favoring larger effective orifice area
- Future coronary access and redo TAVR may require frame crossing, added planning, or explant



Shorter frame
Balloon-expandable, intra-annular design

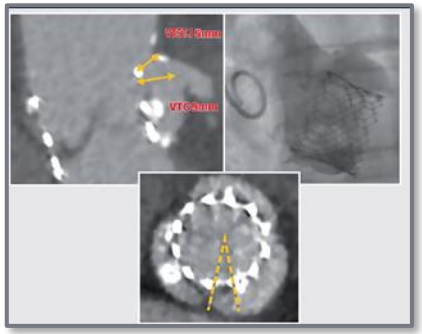
- Short frame stays below the coronary ostia in most anatomies
- Lower frame height keeps the sinus and ostia directly accessible
- Generally simpler engagement for future PCI and redo TAVR planning

Schematic illustration, not to scale. Frame height and leaflet position relative to the coronary ostia are key drivers of future access and reintervention options.

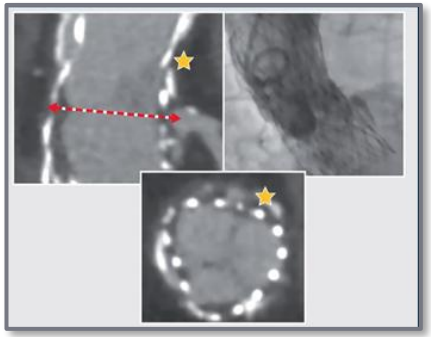
Repeatability

- TAVR valves sit taller than surgical valves and pose more risk for coronary occlusion on TAVR in TAVR procedures particularly due to risk of “sinus sequestration”
- Self expanding frames with their super annular position and taller leaflets pose much greater risk of sinus sequestration and reduce the possibility of repeatability
- Additionally, given the greater risk of causing need for pacemaker with deeper implants, self expanding frames are placed higher increasing the risk of sinus sequestration
- **Balloon Expandable may be preferred in patients expected to outlive their first valve for anatomic repeatability**

Redo-TAVR feasible



Redo-TAVR NOT feasible

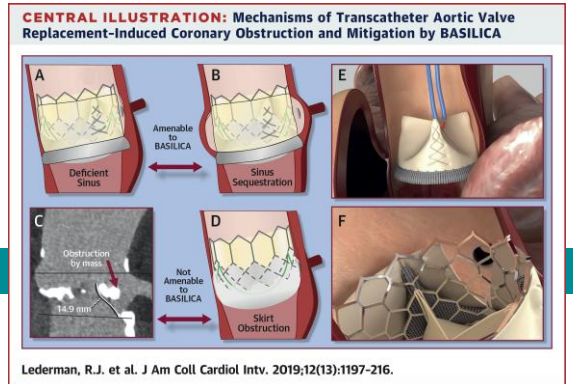


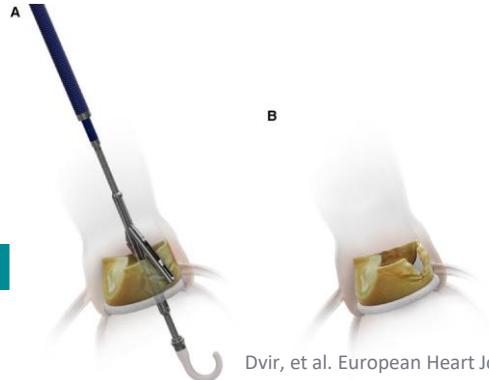
Durability

- Durability matters for patients expected to live more than 5 years
- Even if the anatomy is repeatable, TAVR in TAVR procedures result in a smaller second valve and risk for patient prosthetic mismatch
- Additionally, when self expanding frames with their taller leaflets fail the only option is a balloon expanding valve placed higher which risks coronary obstruction and sinus sequestration
- **When choosing the first valve, clinicians should always model out the feasibility of TAVR in TAVR procedures**

What can Physicians do if there is risk of coronary obstruction with TAV in TAV procedures?

- Surgical Explant is an option but is associated with high or prohibitive risk
- Preventing coronary obstruction
- **Best to start with a valve that does not risk coronary obstruction with future TAV in TAV procedures**





Dvir, et al. European Heart Journal. 2024

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So why is this important for you to know?

- **Not all TAVR is the same and TAVR valves are not a commodity.**
  - Ease of use
  - Radial force
  - Coronary access
  - Repeatability
  - Durability
  - Hostal annular calcium and extremely small annulus may favor SE platforms
- **There is significant value to matching TAVR platform to patient and anatomic characteristics now and to preserve future options**