Transcatheter Aortic Valve Replacement (TAVR)

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Introduction:

Transcatheter aortic valve replacement (TAVR) "is a cardiac intervention first introduced in 2002 to provide treatment for high-risk patients requiring standard surgical interventions"

(Siordia JA, Skaria R, and Subramanian S., 2016)

About Cardiac Catheterization:

- "Modality that requires a minor surgical procedure involving the introduction of specialized catheters into the heart and surrounding vasculature"
- "Done for the purpose of diagnostic evaluation and therapy associated with various cardiovascular-related disorders in children and adults"
- "Cardiac Cath is a procedure that is performed to test a hearts function"

Long, B. W., Rollins, J. H., and Smith, B. J. (2019)

Cardiac Cath Lab

(Havrda, J. B., and Paterson, E., 2019)

Reason for a TAVR

- Aortic Stenosis (AS)
  - Narrowing of aortic valve, limiting blood flow to body
- Causes of AS
  - "3 known causes of AS- rheumatic disease, calcific disease, and congenital valve disease"
  - (Lauck, S., Perpetua, E. M., Hawkey, M. C., and Simone, A., 2019)

Advantages of TAVR:

- Quicker recovery times
- Less invasive than open heart surgery
- Minimal sedation, conscious sedation compared to general anesthesia for open heart

Equipment Involved in a TAVR:

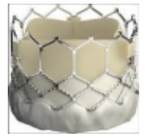
- C-arm/x-ray table
- Manifold
- Sheaths
- Closure Devices (Perclose, Angioseal, or Minx)
- Micro-puncture kit
- Valve
- Pacer
- Valves
- Wires (grandslam, j-wire, straight wire, amplatz wire, luderquist wire)
- Catheters (pigtail, JR, JL)
- Balloon pump

Steps of TAVR:

1. Get access (artery/vein)
2. Insert pacemaker
3. Find coplanar view (RCC, NCC, and LCC all in same plane)
4. Cross aortic valve
5. Pre-treat aortic valve (if needed)
6. Prep valve delivery device
7. Placement of new valve
8. Deploy valve
9. Take ECHO
10. Remove everything
11. Use closure devices to close up

Two Types of Valves:

Edwards SAPIEN series



Balloon-expandable

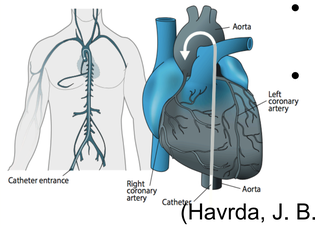
Medtronic series Value Core

Self-expandable

- Only two commercially approved valves in the United States
- Intermediate, high, and extreme risk
- Valve-in-valve

(Vahl, Kodali, and Leon, 2016)

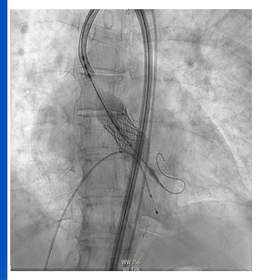
Transfemoral Approach:



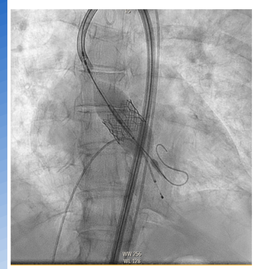
- Micro-puncture kit is used to get access
- Wires/catheters go in femoral artery/vein all the way to the heart

(Havrda, J. B., and Paterson, E., 2019)

TAVR Images:

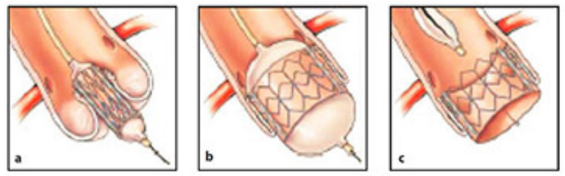


The deployment device slowly blowing up the balloon to expand the new valve. The three cusps are lined up in the coplanar view so the valve does not occlude any of the coronaries.



The balloon blown up as the heart is being paced at about 180 bpm. Once the balloon is blown up, it is held up for about 5 seconds, then it is deflated and the deployment device is removed.

(Geisinger Community Medical Center, 2021)



In picture A, the doctor needs to assure that the valve sits in the coplanar view. In picture B, a couple steps occur while the valve is being deployed. They are: pacer on, inject, inflate, deflate, pacer off. In image C, the valve is completely deployed and the equipment is removed from the body.

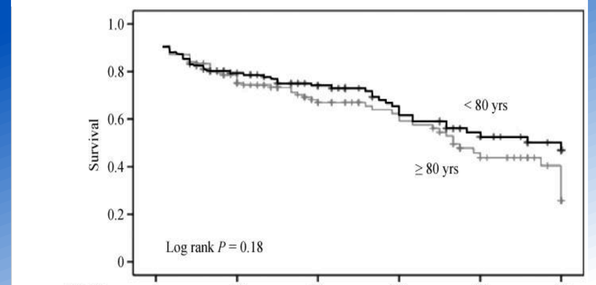
(Kumbhani, D., MD., 2019)

Concerns About TAVR:

- 1. The data are too short-term, and patients might need surgery later.
- 2. TAVR in low-risk patients is not yet FDA-approved, but patients want it now.
- 3. Benefits of TAVR may not balance potential long-term risks.

(Kumbhani, D., MD., 2019)

Statistics for Survival:



	Months	1	12	24	36	48	60
< 80 yrs	No. at risk	142	94	73	51	29	16
	Survival, %	90	79	74	61	52	50
≥ 80 yrs	No. at risk	132	90	58	40	23	11
	Survival, %	91	75	67	59	43	40

Kaplan Meier survival curves for patients < 80 *vs.* ≥ 80 years old. This graph showed a "mean survival (41.0 ± 2.1 vs. 38.2 ± 2.2 months, respectively, P = 0.18"

(Kahraman Ay N., 2019)

Outcomes:

Successful therapeutic intervention for high-risk patients

- Primary outcome was risk-adjusted mortality at 30 days
- Secondary outcomes included a 30-day composite complication outcome
  - (stroke, moderate or severe paravalvular leak, major vascular access-site complications or Valve Academic Research Consortium major or life-threatening or disabling bleeding, or acute kidney injury)

(Vemulapalli, S., MD, et al., 2019)

Conclusion:

In conclusion, TAVR is continuing to evolve and become more sufficient for patients compared to open heart surgery. It proceeds to create new aortic valves and it is a good option for high risk patients to have cardiac surgery.

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