P-ISSN: 2617-9806
E-ISSN: 2617-9814

Impact Factor: RJIF 5.2
www.nursingjournal.net

International Journal of Advance Research in Nursing

Volume 8; Issue 1; Jan-Jun 2025; Page No. 369-372

Received: 13-01-2025
Accepted: 15-02-2025

Indexed Journal
Peer Reviewed Journal

TAVI- Transcatheter Aortic Valve Implantation: A case presentation (A new hope for life prolongation of elderly population)

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DOI: https://www.doi.org/10.33545/nursing.2025.v8.i1.E.480

Abstract
Aortic valve stenosis is the most common valvular heart disease, for past few years surgical aortic valve replacement was the gold-standard treatment for severe aortic stenosis. Improvements in medical therapies have paved way for the entry of Transcatheter Aortic Valve implantation (TAVI) for elderly population who were considered high risk for SAVR (Surgical Aortic Valve Replacement). This article review on TAVI indications, procedure approach, prosthetic valve type, pre and post procedure nursing care, potential complications and home care.

Keywords: Transcatheter aortic valve implantation, Aortic valve stenosis, pre procedure care, post procedure care, complications, home care

Introduction
TAVI or TAVR stands for Transcatheter Aortic valve Implantation or Transcatheter Aortic Valve Replacement is minimally invasive procedure which involves a collapsible prosthetic valve placed directly over the native diseased valve, has emerged as a minimally invasive alternative to SAVR [2]
TAVI can be an effective option to improve quality of life in patients who otherwise have limited choices for repair of their aortic valve [2].

Incidence
However more than 15yeards passed since TAVI was introduced, more than 500,000 procedures have been performed worldwide and more 8000 published reports have clarified the benefits and risks associated with TAVI [1].

History
During the past 50 years the standard of care for severe, symptomatic aortic stenosis has been surgical aortic valve replacement (SAVR), which improves survival, symptoms and quality of life. However some patients are deemed unsuitable for SAVR due to multiple comorbities and anatomic factors.
In 1965, Davis was the first to describe a catheter mounted cone shaped valve that had a parachute configuration which prevented aortic regurgitation and allowed forward flow
In mid 1980s, there was initial optimism that balloon aortic valvuloplasty became the standard of care for percutaneously treating aortic stenosis. However early restenosis became growing procedural complications.
On April 16, 2002 by Cribier set the stage for the first transcatheter aortic valve replacement on a 57 year old man with severe aortic stenosis, the patient eventually died 17weeks following valve implantation.
In 2006, Webb valve implants in 18 patients via retrograde approach via femoral artery, on folloe up of 75days 16 patients were alive with fully functional valve TAVI gradually matured since its first clinical use in 2002 and new design continue to improve the efficacy and feasibility of the procedure [5].

Indications
The decision to treat severe aortic stenosis with SAVR/ TAVI must take account of TAVI in patients who meet an indication for AR for AS who has prohibitive surgical risk and a predicated post TAVR survival >12 months.

- TAVR is a reasonable alternative to surgical AVR for symptomatic patients with severe Aortic stenosis and intermediate surgical risk, depending on patient specific procedural risks, valves and preferences.
- TAVI is recommended for symptomatic patients with severe AS and high risk for surgical AVR, depending on patient- specific procedural risks, values and preferences [7].

Special considerations
1. Advanced age – older adults for>80years
2. Considerations in younger patients
3. Coronary disease – TAVI offers concomitant coronary angioplasty
4. Renal disease – TAVI has low rates of acute kidney injury
5. Lung disease – TAVI can avoid thoracotomy and

intubation
6. Liver disease – lower procedural bleeding risk
7. Failed bio prosthetic valve [10]

Contraindications
1. Highly calcified aorta (porcelain aorta)
2. Chest cavity limitations
3. CABG with susceptible graft injury
4. Severe liver diseases or cirrhosis
5. Pulmonary hypertension
6. Severe right ventricular dysfunction [4].

Diagnostic work-up
1. Heart team evaluation
2. Risk scores

STS score
Society of Thoracic Surgeons (STS) scores are used by the heart teams to screen patients for mortality risk in Transcatheter Aortic valve Replacement. It includes demographic and clinical variables. Based on the calculated STS PROM, classify patients into three risk[5]
High risk of mortality >8%
Intermediate risk >4%
Low risk <4%

EuroScore
3. History and physical exam:

Symptom:
- Exertional dyspnea
- Decreased exercise tolerance
- Angina
- Syncope
- Systolic cresecendo decrescendo ejection murmur
- Pulsus tardus
- Pulsus parvus

4. Echocardiography
Transthoracic echocardiogram is generally the first imaging test ordered Aortic valve area of <1cm2, peak velocity across the valve>4m/s and mean gradient>40mmhg) [5]

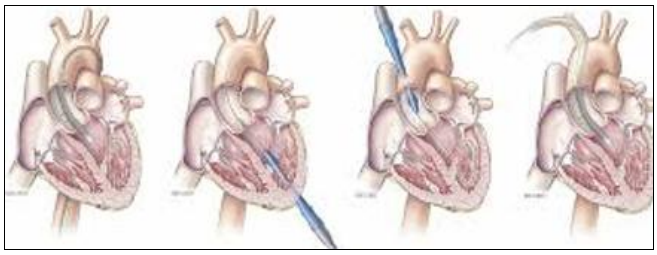
5. Multidetector Computed Tomography
Computed tomography can accurately evaluate ilifemoral tortuosity, calcium burden and size. The minimal vessel diameter varies depending on the type and size of valve being used, but general a minimal diameter of 5.5mm is recommended for transfemoral TAVR.[5]

6. **Right Heart Catheterization and coronary Angiography**

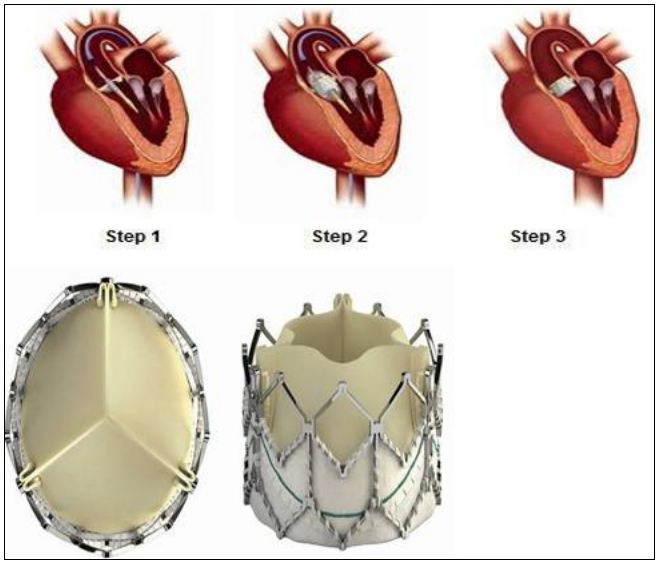
Right and left heart catheterization is used to evaluate for concomitant pulmonary hypertension or coronary artery disease which is very common in patients undergoing TAVR.

7. Other testing:
Renal function test
Pulmonary function tests
Carotid ultrasound
Dental evaluation.

TAVR approaches and procedure
Approved TAVR techniques include
- Percutaneous approaches (Trans femoral, transaxillary/subclavian)
- Open approaches (Transapical, transaortic) [3]



About 90% of TAVR use trans femoral approaches
- A small incision is made through which a short, hollow tube called a sheath into the femoral artery.
- The new valve is then placed on the delivery system. The new valve is compressed to make it small enough to fit through the sheath.
- The delivery system carrying the valve is pushed up to aortic valve. Once it reaches the valve, the new valve pushes aside the leaflets of your diseased valve. The existing valve holds the new valve in place.
- The new valve will open and close as a normal aortic valve, ensure new valve is working properly before closing the incision in leg.
- Patient may feel relief from symptoms soon after their TAVI procedure done.
- The patients only requires 2-3 days of admission.



Replacement Valve Options
The Food and Drug Administration (FDA) has approved two valves for TAVR

Edwards Life Sciences SAPIEN valves
SAPIEN XT and SAPIEN 3 are made with bovine pericardium, valves are expandable.
SAPIEN XT is approved for valve-in-valve procedures for patients for patients with failed or deteriorating previously replaced tissue SAPIEN 3 has a sealing cuff to minimize

paravalvular regurgitation.

Medtronic Core Valve

It is a trileaflet porcine pericardial valve can be recaptured and repositioned during placement of valve [3].

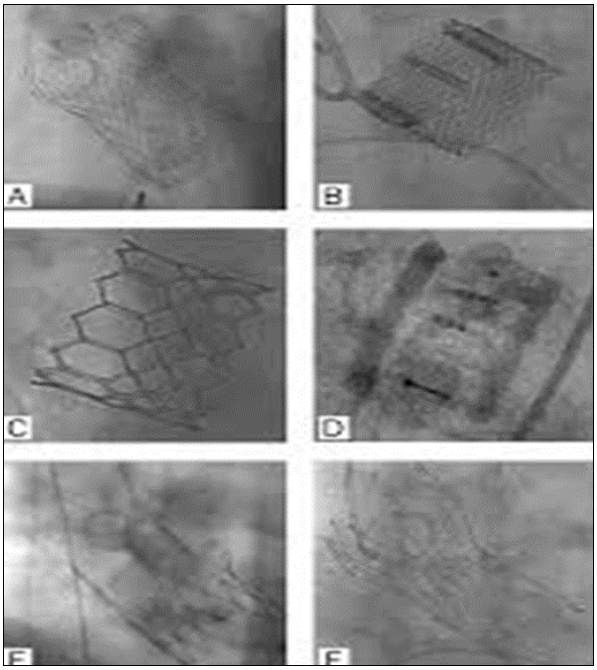
Case presentation

Mrs. A,77 yr old female was admitted with history on exertion since 8 months increased over the past 2 months, NYHA class II. No chest pain, palpitation, syncope or pedal edema. Not known co-morbities. On oral medications Tab. Aspirin 75 mg, Tab. Atorvastatin 10 mg.

Her ECHO showed severe aortic stenosis, calcified bicuspid aortic valve, AVA 0.69 cm2, MPG 46 mmhg.

Her case was discussed in the heart team and she was considered a poor candidate for surgery with high risk in view (STS score risk of mortality 7.54%, Euroscore II 6.31%). She was planned for TAVI. She underwent procedure a 23 mmMy-valve balloon expandable valve was implanted.

Post procedure she was started on antiplatelets and anticoagulants prophylactic antibiotics were given. Her post TAVI ECHO revealed normally functioning bio-prosthetic valve, no paravalvular leak.



Nursing care of Patients undergoing TAVI:

Pre procedure care

1. Assess the patient knowledge of procedure and explain procedure
2. Perform 12lead ECG
3. Administer morning dose of routine medications with sips of water
4. Ask to empty his/her bladder
5. Make sure the doctor get the consent from the patient
6. Start IV line
7. Check for any drug allergies
8. Advice for starvation before procedure according to the order
9. Remove jewelry, eyeglasses, contact lens, dentures, nail polish.
10. Prepare the small area in both groin and advice to take shower
11. Administer antianxiety drug if needed [4]

Post procedure care

1. Continous cardiac monitoring
2. Patient who had percutaneous approach should rest for 6 hours bed rest
3. Early mobilization to prevent potential complications(DVT)
4. If the femoral artery was accessed during procedure, keep the head of the bed elevated 30 degree to minimize bending at the groin at the puncture site.
5. Check for the level of alertness, recovery from sedation
6. Auscultate heart sounds
7. Monitor the site distal to puncture for adequate circulation
8. Perform neurovascular assessment of the affected extremity (color, temperature, pulse, numbness, tingling and swelling)
9. Assess the insertion site for signs of bleeding, hematoma and infection
10. Keep the procedure site clean, dry and intact and look for bleeding.
11. Monitor fluid balance to prevent preload dependent.
12. Ensure transcutaneous pacing pads remain on the patient
13. Collect routine lab specimens (CBC, renal function test, coagulation profile) [4]

Post- Procedure complications

Immediate complications

1. Hypotension

- Monitor vital signs
- Avoidance of excessive low systolic (120 mmHg) or diastolic (60mm Hg) BP within 30 days after TAVI
- Administer IV fluids
- Assess for dissection or perforation
- Administer inotropes if needed
- Rigorous medication tracking on antihypertensives drug
- Put the head end flat
- Assess urine output
- Avoidance of negatively chronotropic drugs

2. Paravalvular regurgitation

- Monitor vital signs
- Monitor atrial blood pressure
- Assess for murmurs and heart sound changes
- Ensure ventricular pacing at 90 to 110bpm

3. High degree AV block

- Monitor patient heart rate.
- Monitor for settings of temporary pacemaker if patient is connected.
- Monitor for signs and symptoms of chest pain, dizziness, syncope.
- Continuous cardiac monitoring.
- Keep the emergency external pacing pads at the bedside of the patient.
- Cautiously administer medications that alter heart rate.

4. Stroke
- Provide supplemental oxygen if needed
- Monitor vital signs
- Periodic neurologic assessment to be continued – pain, pallor, parathesia, polkilothermia, pheripheral pulse,
- Treat hyperthermia
- Use assessment tools (CPSS – Cincinnati prehospital stroke scale, NIHSS – National Institutes of Health Stroke Scale)
- Start the patient on anticoagulant and antiplatelets drugs
- Monitor for mental status changes
- Activate stroke protocol if needed
- Assess for the phase of the stroke

5. Bleeding
- Monitor for procedure site and distal limb for signs of occlusion, hematoma, pseudoaneurysm.
- Ensure tight bandage over the procedure site.

6. Acute kidney injury
- Monitor for fluid balance and urine output
- Maintain adequate hydration
- Prevent hypotension.
- Monitor serum creatinine level.

7. Paravalvular leak
- Monitor signs and symptoms of paravalvular leak – shortness of breath, heart flutter, atrial fibrillation, easy fatigue, heart failure
- Check out for haemoglobin level
- Administer diuretics if heart failure symptoms exist
- Check for abnormal heart sound like murmur [9]

Long term complications:
1. Paravalvular regurgitation
2. Endocarditis
3. Valve thrombosis.

Home care
1. Patient should be on dual antiplatelet therapy
2. Monitor for complications
3. Recognizine progressive activity
4. First 2 weeks after TAVI avoid activities include pushing, pulling, lifting any weight of more than 10kg
5. Educate on infective endocarditis prophylaxis
6. Advice the patient to balance physical activity with rest
7. Plan a walking program, goal is to work up 20 to 30 minutes of walking every day
8. Advice on exercise like deep breathing, trunk rotation, shoulder flexion, shoulder exercise, ankle pumps, knee raise, knee extension
9. Advice to watch for any symptoms of pain, breathlessness,
10. Avoid travelling for the first month. Do not drive for four weeks after implantation.
11. Tell the patient to track weight daily to rule out early fluid load.
12. Maintain a heart healthy, low salt diet
13. Advice to prevent complication from dental work
14. Advice for regular follow up [8]

Conclusion
TAVI is increasing dramatically. It has proven to be safe and effective alternative for SAVR. By understanding various aspect of TAVI it helps to ensure the best possible patients outcomes.

Conflict of Interest
Not available

Financial Support
Not available

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How to Cite This Article
Jeevitha J. TAVI- Transcatheter Aortic Valve Implantation: A case presentation (A new hope for life prolongation of elderly population). International Journal of Advance Research in Nursing. 2025;8(1):369-372