Echocardiographic Assessment for TAVI

Gerald Yong MBBS (Hons) FRACP FSCAI
Interventional Cardiologist
Royal Perth Hospital
Western Australia

Use Of Echocardiography In TAVI

- Assessment pre TAVI
- Assessment during TAVI
- Assessment post TAVI

Echo Assessment Pre-TAVI

- Ensure correct diagnosis
  - Calcified valve with restricted motion
  - Consistent hemodynamics
- Assessment aortic valve morphology
  - Leaflet number - bicuspid, tricuspid
  - Calcification - bulky Ca, symmetry, extent of Ca
- Assessment of aortic annulus and root
  - Annulus diameter, aortic root diameter, sinus height
- Assessment of other features that impact on risk or technical feasibility of TAVI
  - LV function, aortic / mitral / tricuspid regurgitation, PA pressure, presence of pericardial effusion
  - LV hypertrophy, Sigmoid septum
  - Cardiac mass
  - Aortic atheroma

Severe Calcified Aortic Stenosis

2D (LAX) 2D (SAX)
**Severe AS Doppler**
- High peak and mean vel.
  - Vmax >4m/sec
  - Mean grad >40mmHg
- AVA – continuity equation
  - ≤1cm²
- VTI ratio \( \frac{VTI_{LVOT}}{VTI_{AV}} \)
  - <0.25
- Beware LVOT velocity
  - Increased in HCM, subaortic membrane, AR

**Aortic Leaflet Morphology - Bisucpid vs Tricuspid**
- 68yo man 10 years post heart Tx
- Severe AS
- Bicuspid aortic valve
- Concerns
  - Non-circular stent expansion → PVL
  - Poor seating

**Transcatheter Aortic Valve Implantation in Patients With Bicuspid Aortic Valve Stenosis**
- 11 bicuspid valve treated with TAVI using Edwards SAPIEN valve
- 1 conversion to surgery
- 2 moderate AR
- Circular stent expansion in all 11 cases

**Aortic Valve Morphology - Bulky Calcium**
- Concerns
  - Coronary occlusion
  - PVL

**Aortic Annulus Measurement**
- EXTREMELY IMPORTANT – Determines size of valve
  - Edwards SAPIEN / XT
    - 16-21 – 23mm Valve
    - 21-25 – 26mm Valve
  - CoreValve
    - 20-23 – 26mm Valve
    - 23-27 – 29mm Valve
  - Sometimes it is not so easy
    - LAX: Zoom and high frequency
    - Measure in systole from leaflet insertion points on the LV side of AV
  - Confirm on the TEE if in doubt
Aortic Annulus Measurement

TOE:
- LongAxis view
- See valve leaflets
- See the leaflet insertion / hinge

Heavy calcified leaflets create acoustic shadows
Re-position the probe often move the shadows away from the leaflet insertion points

Check on the different view and different heart beat
Generally, the largest diameter should be used!

Calculation for the Area Derived Diameter:

\[
diameter = 2 \sqrt{\frac{A}{\pi}}
\]
Correlation of Aortic Annulus Measurements

CT > TEE > TTE

Aortic Root Measurements

LV Hypertrophy / Sigmoid Septum

Concern - Potential for ejection of balloon expandable valve

Pre-TAVI Echo Assessment – Other Surprises

Pre-TAVI Echo Assessment – Other concerns
**Echo Assessment During TAVI**

- Not routine for CoroValve
- Previously mandated for Edwards valve. Now optional
- Use of TEE during TAVI → Frequently implies GA

**Positioning of Edwards Valve**

Visualization of current generations of SAPIEN / XT valve can be difficult due to nose cone

Best visualized at proximal end of valve

- Balloon Shaft
- SAPIEN
- Tapered Distal End

**Echo Assessment During TAVI**

- Quickly check all the findings from the "pre" Echo
- Re-measure the annulus size
- Determine the success of the BAV and the severity of AR following the BAV
- If used for Edwards valve – assist in positioning
  - Select and provide the view the operator wants – typically 3C LAX
  - Determine the position of the prosthesis before deployment
- After the deployment, to ensure the position/stability of prosthesis, severity and mechanism of AR
- Assessment of complications – esp if hypotensive

**Echo Assessment During TAVI**

- Be part of team
- Be a clinician
  - Knowing what is going on
    - How is our patient doing?
    - What stage is the procedure
    - Anticipate what should you look to assist the success and to reduce the risks.
- Communicate and talk the same language
  - Complication assessment
  - Positioning – describe position as “aortic” or “ventricular”

**Positioning of Edwards valve**

Can be difficult on TEE

Adjunct to fluoroscopy

Aim for 60% in LV, 40% in aorta

Ventricular end at level of AMVL hinge point

Aortic end cover leaflet tips
Post-Deployment

- Assess valve position
- Assess expansion of valve
- Assess regurgitation (central and paravalvular)

Assessment of Complications
In case of Hypotension...

- Anytime after pacing wire or stiff guide-wire introduced
  - Pericardial tamponade
- After stiff wire introduced to LV
  - Wire-induced mitral regurgitation
- Post-BAV
  - Severe AR
- Post-valve deployment
  - Severe AR (valvular or paravalvular)
  - Coronary occlusion – new regional wall motion abn

Hypotension Post Valve Deployment

3-4+ MR

Wire entanglement

Hypotension Post-BAV

MR resolved after guidewire removed
Echo Assessment Post TAVI

- Generally TTE is sufficient
- Standard study to check the prosthesis
- Quantify the severity and mechanism of aortic regurgitation.
- Check the favorable remodelling of the heart following TAVI
- Assessing the durability of the prosthesis

Conclusion

- A thorough echocardiographic examination is vital for the planning of TAVI
  - Assess annulus
  - Assess leaflet morphology
  - Assess other factors which affects risks and technical feasibility of TAVI
- Echocardiographic guidance during TAVI procedure has become optional (even in procedures involving balloon expandable Edwards valve) but is useful for
  - Assessment of final valve functioning and regurgitation post-deployment
  - Assessment and management of complications