Echocardiographic Assessment for TAVI

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Meeting Name

Disclosure Statement of Financial Interest

Within the past 12 months, I or my spouse/partner have had a financial Interest /arrangement or affiliation with the organization(s) listed below

Affiliation/Financial Relationship	Company
Grant/ Research Support:	
Consulting Fees/Honoraria:	**Edwards Lifesciences (consultant & proctor)**
Ownership/Founder:	
Salary:	
Intellectual Property Rights:	
Other Financial Benefit:	

I AM NOT AN ECHOCARDIOLOGIST!!

BUT… I HAVE HAD TO GET A GOOD UNDERSTANDING OF ECHO DUE TO TAVI PROGRAM

Use Of Echocardiography In TAVI

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

Echo Assessment Pre-TAVI

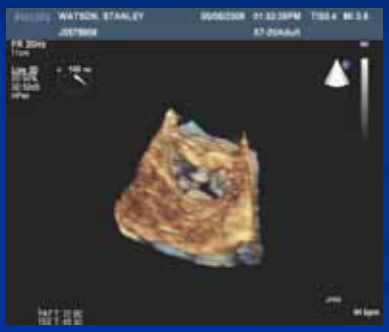
- Ensure correct diagnosis
  - Calcified valve with restricted motion
  - Consistent hemodynamics
- Assessment aortic valve morphology
  - Leaflet number – bicuspid, tricuspid
  - Calcification – bulky Ca, symmetry, extent of Ca
- Assessment of aortic annulus and root
  - Annulus diameter, aortic root 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)

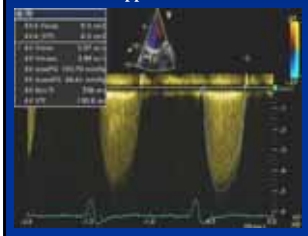
2D (SAX)

Severe Calcific Aortic Stenosis



Severe AS Doppler

CW Doppler



- High peak and mean vel.
  - Vmax >4m/sec
  - Mean grad >40mmHg
- AVA – continuity equation
  - $<1cm^2$
- VTI ratio (VTI_{LVOT}/VTI_{AV})
  - <0.25
- Beware LVOT velocity
  - Increased in HCM, subaortic membrane, AR

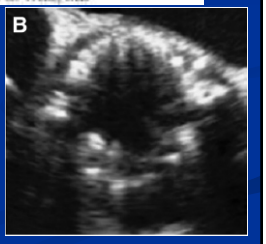
Aortic Leaflet Morphology – Bisucpid vs Tricuspid

- 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

Namal Wijesinghe, MBBS, MD,* Jian Ye, MD,* Josep Rodés-Cabau, MD,† Anson Cheung, MD,* James L. Velianou, MD,‡ Madhu K. Natarajan, MSc, MD,‡ Eric Dumont, MD,† Fabian Nietlispach, MD,* Ronen Gurvitch, MBBS,* David A. Wood, MD,* Edgar Tay, MBBS,* John G. Webb, MD*

- 11 bicuspid valve treated with TAVI using Edwards SAPIEN valve
- 1 conversion to surgery
- 2 moderate AR
- Circular stent expansion in all 11 cases

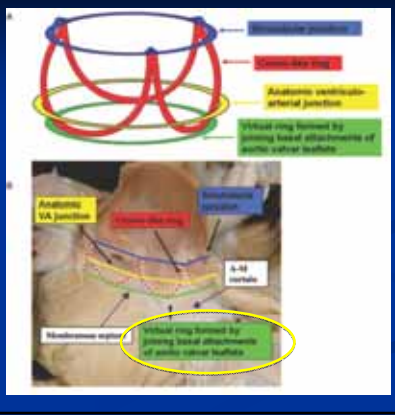


Aortic Valve Morphology – Bulky Calcium

Concerns
-Coronary occlusion
-PVL

Aortic Annulus Measurement

- EXTREMELY IMPORTANT – Determines size of valve
  - Edwards SAPIEN / XT
    - 18-21 – 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:

- **Long Axis view**
- **See valve leaflets**
- **See the leaflet insertion / hinge**

Aortic Annulus Measurement

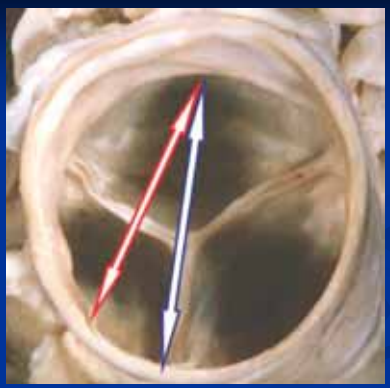
Heavy calcified leaflets create acoustic shadows

Re-position the probe often move the shadows away from the leaflet insertion points

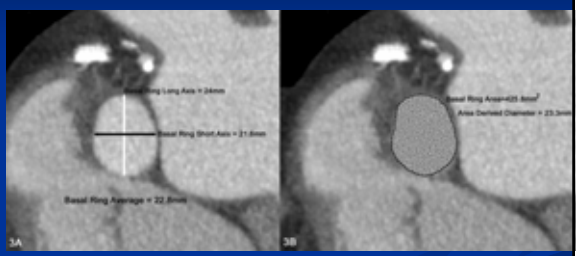
Aortic Annulus Measurement

Check on the different view and different heart beat

Generally, the largest diameter should be used!



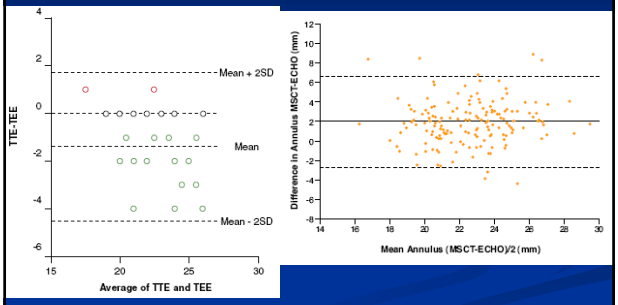
Aortic Annulus Measurement - CT



Calculation for the Area Derived Diameter

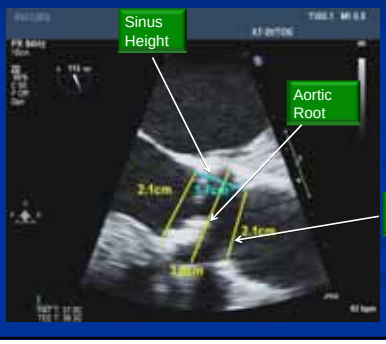
$$diameter = 2\sqrt{\frac{area}{\pi}}$$

Correlation of Aortic Annulus Measurements



CT > TEE > TTE

Aortic Root Measurements

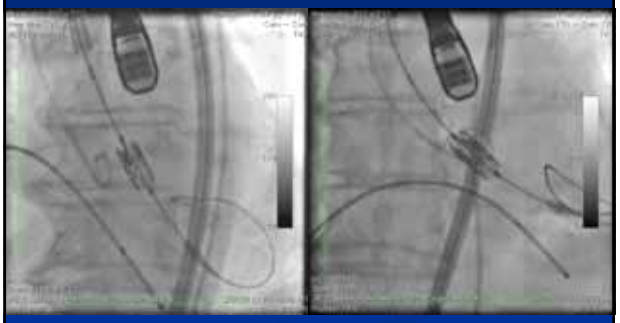


LV Hypertrophy / Sigmoid Septum

Concern
- Potential for ejection of balloon expandable valve

SAPIEN XT Deployment in normal sized LV

SAPIEN XT Deployment in septal bulge



Pre-TAVI Echo Assessment – Other Surprises

Pre-TAVI Echo Assessment – Other concerns

Echo Assessment During TAVI

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

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

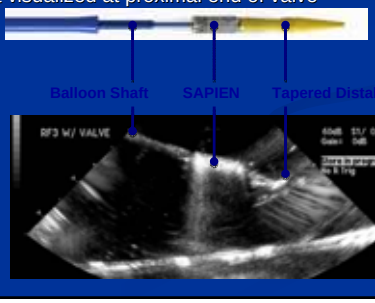
Echo Assessment During TAVI

- 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

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

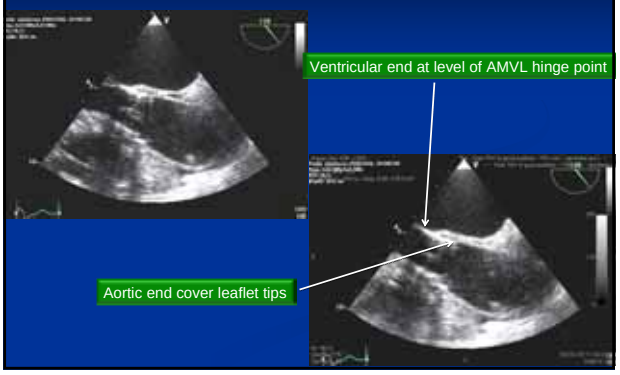
- Best visualized at proximal end of valve



Positioning of Edwards valve

Can be difficult on TEE
Adjunct to fluroscopy

Aim for 60% in LV,
40% in aorta



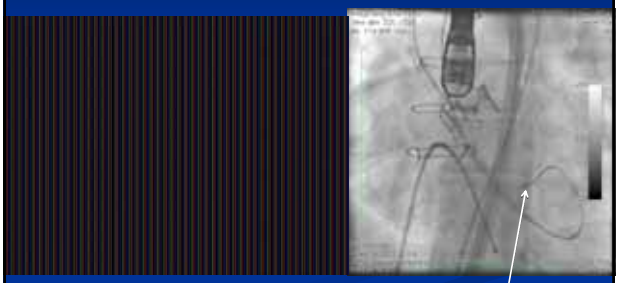
Post-Deployment

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

Assessment of Complications In case of Hypotension…

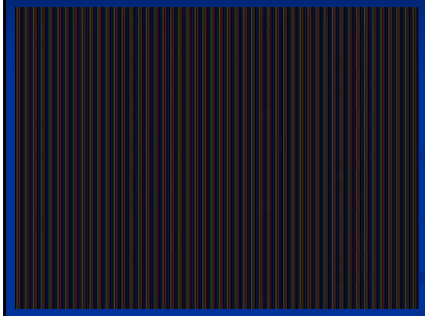
- Anytime after pacing wire or stiff guide-wire introduced
  - Pericardial tamponade
- After stiff wire introduced to LV
  - Wire-induced mitral regurgitation
- Post-BAV
  - Severe AR
- Post-valve deployment
  - Severe AR (valvular or paravalvular)
  - Coronary occlusion – new regional wall motion abn

Hypotension Post Valve Deployment



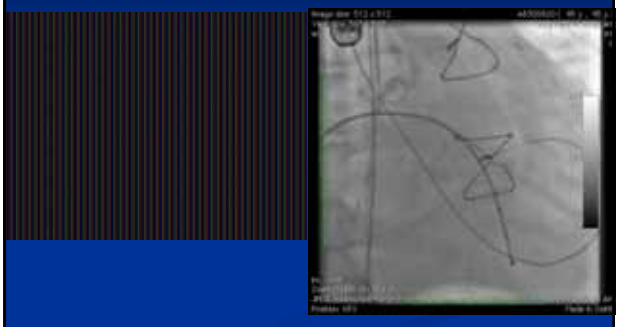
3-4+ MR

Wire entanglement



MR resolved after guidewire removed

Hypotension Post-BAV



Valve Deployed 1-2+ AR

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