

Prosthetic Valves

*Integrating the New ASE Guidelines
into Daily Clinical Practice*

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No Conflicts to declare



Types of Prosthetic Heart Valves

Biological

Stented

Porcine xenograft
Pericardial xenograft

Stentless

Porcine xenograft
Pericardial xenograft
Homograft (allograft)
Autograft

Percutaneous

Mechanical

Bileaflet
Single tilting disk
Caged-ball

**25 Different Brand names
worldwide...**

> 44 Different Models !

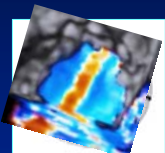
Sizes: 17 - 35 mm

Normal Prosthetic Valves

Determinants of Velocity / Gradient:

- Valve size
- Valve Type
- Flow Rate

Different Flow Profiles and Effective Orifice Areas
For Similar "Size"



ASE GUIDELINES AND STANDARDS
Endorsed by ACC/AHA/ESC-EAE/JCS/CCS

Recommendations For Evaluation Of Prosthetic Valves With Echocardiography And Doppler Ultrasound

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Zoghbi W et al. J Am Soc Echocardiogr 22: 975, 2009

Parameters in the Comprehensive Evaluation of Prosthetic Valve Function

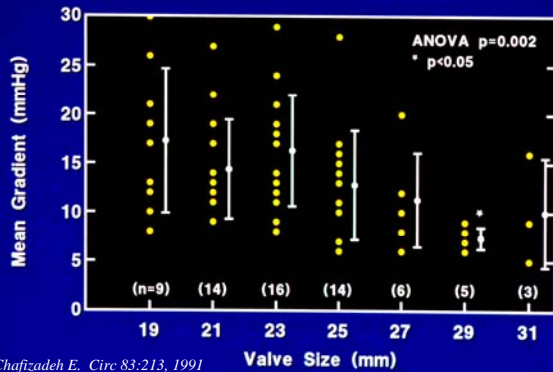
Clinical information

- Date of valve replacement
- Type and size of the prosthetic valve
- Height/Weight/Body surface area
- Symptoms and related clinical findings
- Blood pressure and heart rate

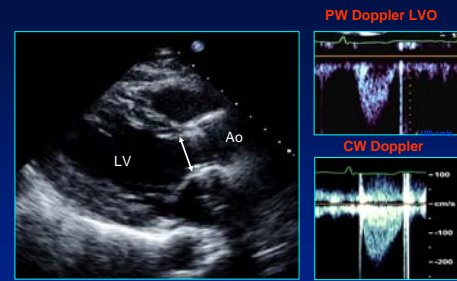
Prosthetic Aortic Valve CW Recording ? Normal or Abnormal



St Jude Medical Valve

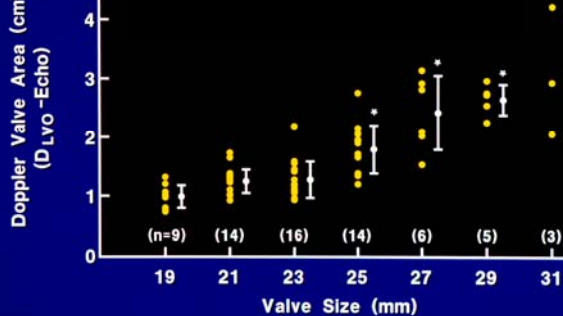


Derivation of Effective orifice Area

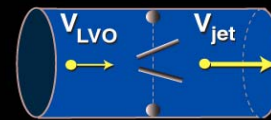


$$\text{Effective Orifice Area} = \frac{\text{CSA}_{\text{LVO}} \times \text{VTI}_{\text{LVO}}}{\text{VTI}_{\text{JET}}}$$

St Jude Medical Valve

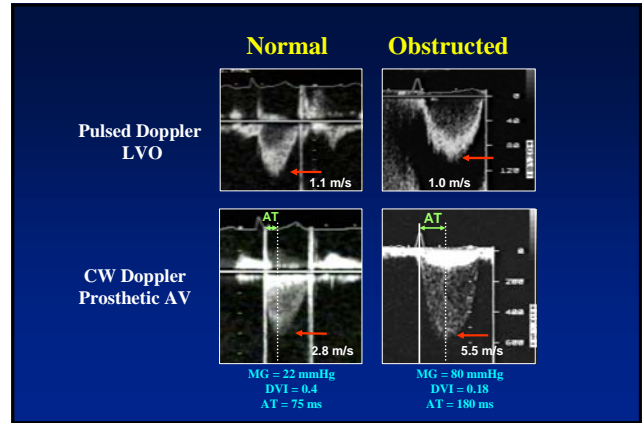
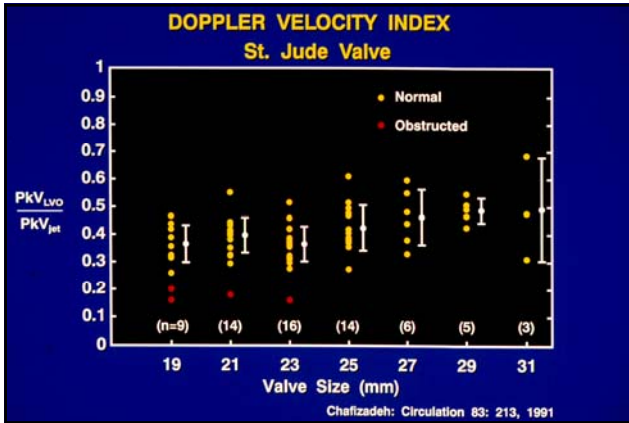


Doppler Velocity Index



$$\text{Doppler Velocity Index} = \frac{\text{Velocity}_{\text{LVO}}}{\text{Velocity}_{\text{jet}}}$$

(Normal > 0.25)



Doppler Parameters of Prosthetic Aortic Valve Function

	SUGGESTS STENOSIS
Peak velocity	> 4 m/s
Mean gradient	>35 mmHg
Doppler velocity index	< 0.25
Effective orifice area	< 0.8 cm ²
Contour of the jet	Rounded, symmetrical contour
Acceleration time	> 100 ms

Comparison with post-operative studies is essential in cases of high gradient

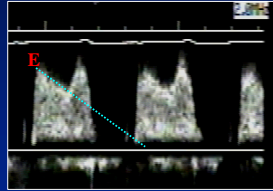
Prosthetic Mitral Valve

Normal	Obstructed
Mean Gr = 4 mmHg PHT = 123 ms EOA = 2.5 cm ²	Mean Gr = 13 mmHg PHT = 200 ms EOA = 1.1 cm ²

- ### Prosthetic Mitral Valve
- #### Traditional Doppler Parameters
- Maximal Velocity
 - Mean gradient: *Importance of heart rate*
 - Pressure half-time
 - Effective orifice area (continuity equation)

Doppler Parameters of Prosthetic MV Function

	Suggests Significant Stenosis
Peak velocity	≥ 2.5 m/s
Mean gradient	> 10 mmHg
EOA (continuity)	< 1 cm ²
Pressure Half-time	> 200 ms

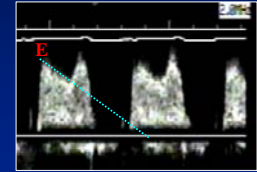


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Prosthetic Mitral Valve

Limitations of Pressure Half-time Method

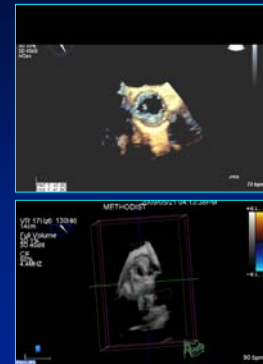
- Merging of E and A velocities (\uparrow PR, tachycardia)
- Delayed LV relaxation
- Decreased LV compliance
- Atrio-ventricular coupling
- Significant aortic insufficiency



Indications of TEE In Prosthetic Valve Obstruction

- Non-diagnostic or borderline cases by transthoracic Echo / Doppler
- Assessment of concomitant regurgitation
- Patients with known severe obstruction: Candidates for thrombolysis

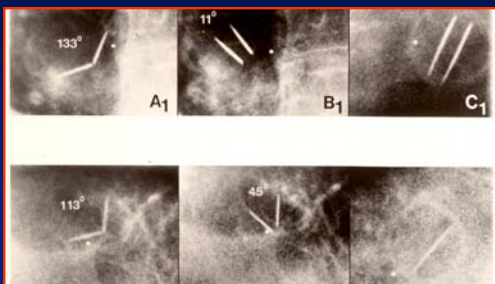
Aortic Position



Mitral Position

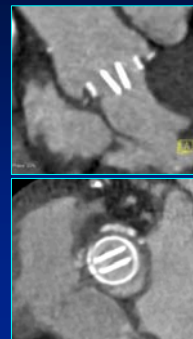


Fluoroscopy May be Need to Assess Valve Mobility in Mechanical Aortic valves



CT Scan in Prosthetic Valves

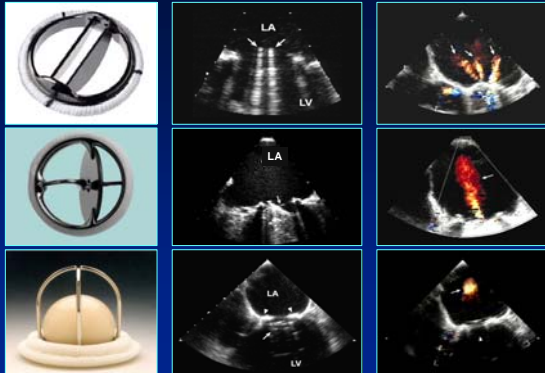
Normal



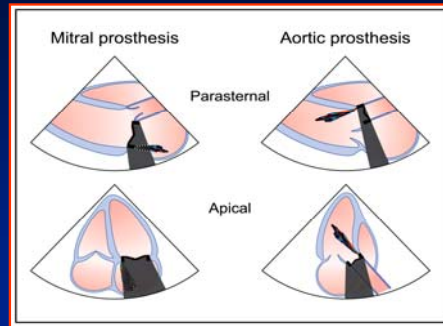
Obstructed-Thrombus



Normal, "Physiologic" Regurgitation

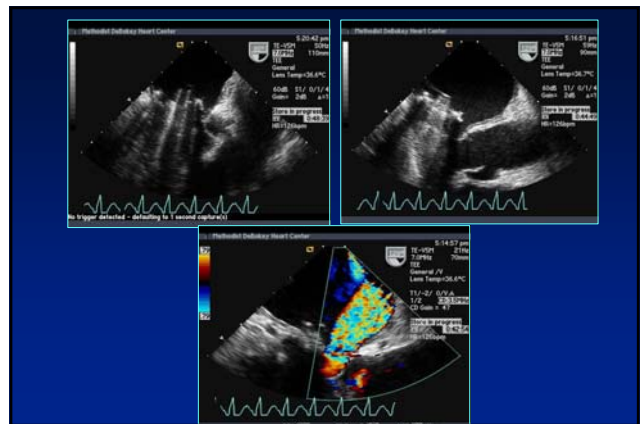
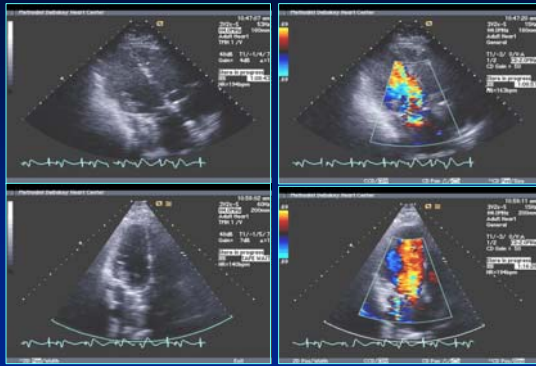


Shadowing & Flow Masking



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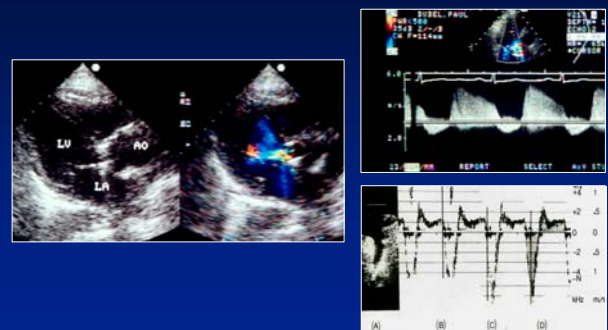
58 M with Prosthetic Mitral Valve



Clues from the Transthoracic Study for Significant MR in Mechanical Valves

- High E mitral velocity (> 1.9 m/s)
- High mean gradient (> 5 mmHg)
- Elevated VTI_{MV}/VTI_{LVO} ratio (> 2.2)
- Good LV function but low systemic output (VTI)
- Pulmonary hypertension (TR velocity > 3 m/s)

Prosthetic Aortic Regurgitation

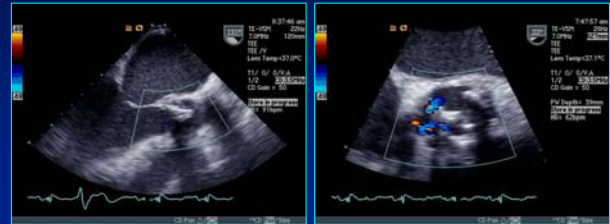


Prosthetic Aortic Regurgitation

Indicators of Severity

- Aortic Valve/ LV enlargement
- Color Doppler: *Proximal jet width/CSA; Vena Contracta > PISA; Beware of eccentric jets*
- Intensity of jet by CW
- Pressure half-time
- Regurgitant Volume/Fraction
- Diastolic retrograde flow in aorta

Prosthetic Aortic Regurgitation TEE helps Identify Etiology & Complications



Educational Summary Poster



www.asecho.org

Comprehensive Evaluation of Prosthetic Valve Function

- Clinical evaluation, know valve Type and Size
- Baseline echo/Doppler study after surgery
- Transthoracic 2D/ Doppler evaluation of structure and function is the first line diagnostic method
- In cases with high velocity jet/gradient and suspected stenosis or regurgitation
 - Compare previous studies
 - TEE, (fluoroscopy if needed for Aortic mechanical PrV, ?CT)