Prosthetic valve-
Pulmonary valve
Tricuspid valve

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Pulmonary valve

- Parasternal short axis view

  Subcostal view for young patients

Limitation:

- TEE, TTE
- RVOT diameter (“funnel”) =>EOA
- Branch pulmonary artery stenosis

  => Doppler scan: pulse wave velocity
- Congenital RV abnormal structure
- Homograft/xengraft valve conduit

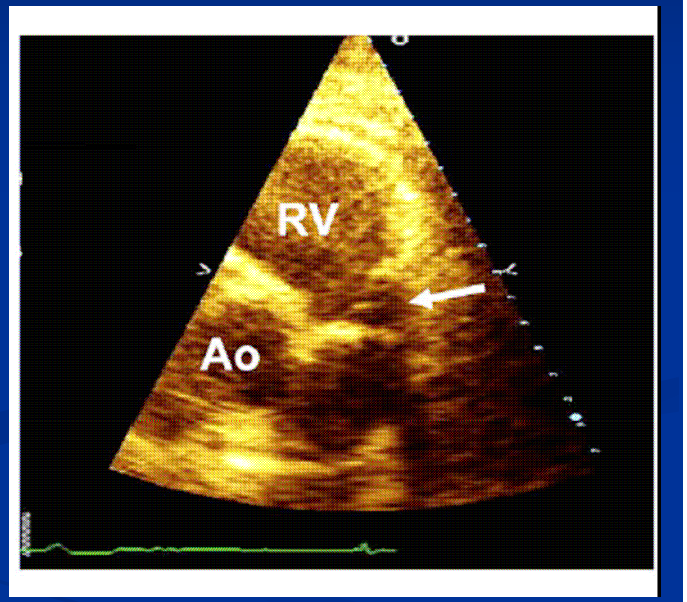


Table 11 Imaging and Doppler parameters in evaluation of prosthetic pulmonary valve function

Doppler echocardiography of the valve	Peak velocity/peak gradient
	Mean gradient
	DVI*
	EOA*
	Presence, location, and severity of regurgitation
Related cardiac chambers	RV size, function, and hypertrophy; RV systolic pressure†

*Theoretically possible to calculate; few data exist.
†The RV dimensions are helpful only for patients who had normal right ventricles prior to valve replacement (ie, Ross procedure).

Pulmonary stenosis

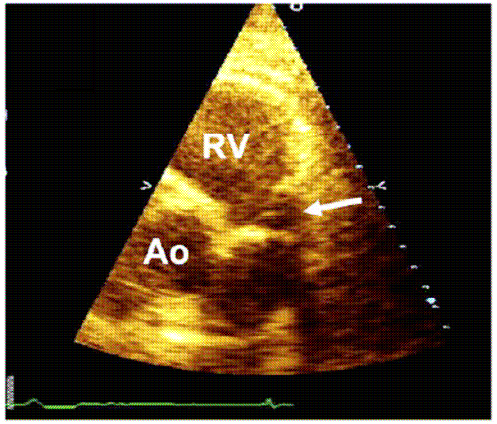
Table 12 Findings suspicious for prosthetic pulmonary valve stenosis

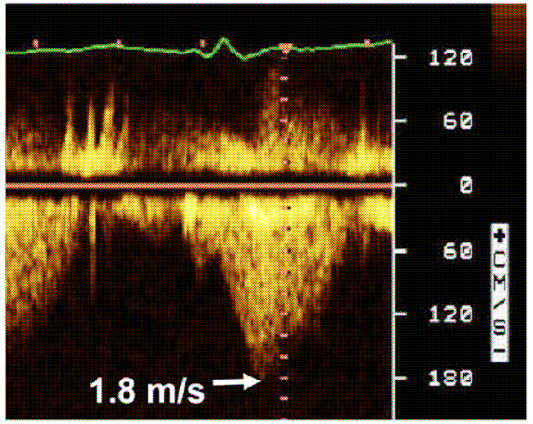
Cusp or leaflet thickening or immobility
Narrowing of forward color map
Peak velocity through the prosthesis >3 m/s or >2 m/s through a homograft*
Increase in peak velocity on serial studies†
Impaired RV function or elevated RV systolic pressure

*Suspicious but not diagnostic of stenosis.
†More reliable parameter.

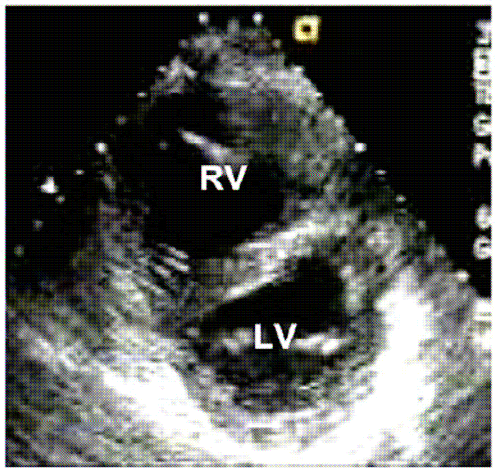
Homograft: peak velocity <2.5m/s, mean PG<15mmHg
Xenograft : <3.2m/s, <20mmHg
Mechanical valve: unknown unknown

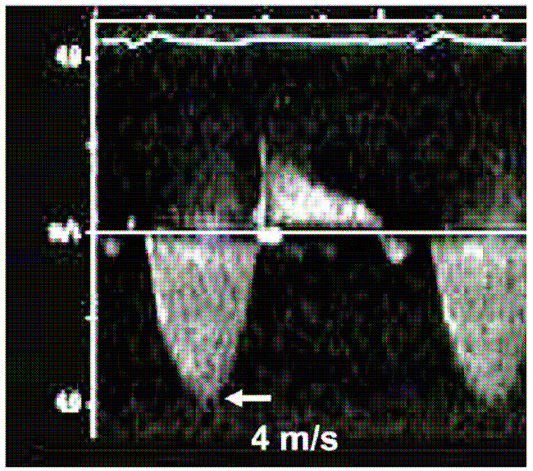
Normal
Pr PV





Obstructed
Pulmonary
Homograft





Pulmonary regurgitation

Table 13 Evaluation of severity of prosthetic pulmonary valve regurgitation

Parameter	Mild	Moderate	Severe
Valve structure	Usually normal	Abnormal or valve dehiscence	Abnormal or valve dehiscence
RV size	Normal*	Normal or dilated	Dilated‡
Jet size by color Doppler (central jets)‖	Thin with a narrow origin; jet width ≤25% of pulmonary annulus	Intermediate; jet width 26%-50% of pulmonary annulus	Usually large, with a wide origin; jet width >50% of pulmonary annulus; may be brief in duration
Jet density by CW Doppler	Incomplete or faint	Dense	Dense
Jet deceleration rate by CW Doppler	Slow deceleration	Variable deceleration	Steep deceleration§, early termination of diastolic flow
Pulmonary systolic flow vs systemic flow by PW Doppler†	Slightly increased	Intermediate	Greatly increased
Diastolic flow reversal in the pulmonary artery	None	Present	Present

Adapted from Zoghbi et al.[16]

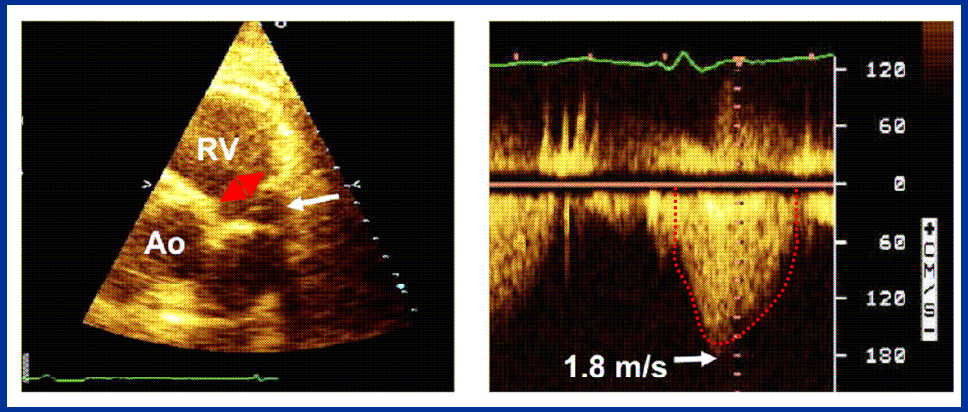
*Unless other cause of RV dilatation exists, including residual postsurgical dilatation.

†Cutoff values for regurgitant volume and fraction are not well validated.

‡Unless there are other reasons for RV enlargement. Acute PR is an exception. RV volume overload is usually accompanied with typical paradoxical septal motion.

§Steep deceleration is not specific for severe PR.

‖At a Nyquist limit of 50 to 60 cm/s; parameter applies to central jets and not eccentric jets.



Pulmonary flow

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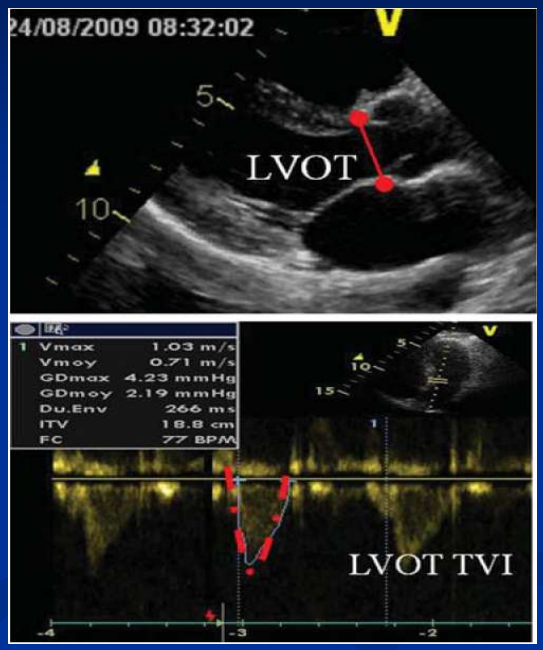

Systemic flow

Regurgitant fraction <30% mild
Regurgitant fraction >60% severe

Tricuspid valve

- Images: Parasternal, lower parasternal, apical, subcostal veiws
- Doppler study: average 5 beats (even sinus rhythm)

Table 14 Echocardiographic and Doppler parameters in evaluation of prosthetic tricuspid valve function

Doppler echocardiography of the valve	Peak early velocity
	Mean gradient
	Heart rate at time of Doppler assessment
	Pressure half-time
	VTI_{PrTV}/VTI_{LVO}*
	EOA*
	Presence, location, and severity of TR
Related cardiac chambers, inferior vena cava and hepatic veins	RV size and function
	Right atrial size
	Size of inferior vena cava and response to inspiration
	Hepatic vein flow pattern

PrTV, Prosthetic tricuspid valve.
*Feasible measurements of valve function, similar to mitral prostheses, but no large series to date.

EOA≠220/pressure half time

Table 15 Doppler parameters of prosthetic tricuspid valve function

	Consider valve stenosis*
Peak velocity†	>1.7 m/s
Mean gradient†	≥6 mm Hg
Pressure half-time	≥230 ms
EOA and VTI_{PrTV}/VTI_{LVO}	No data yet available for tricuspid prostheses

PrTV, Prosthetic tricuspid valve.
*Because of respiratory variation, average ≥5 cycles.
†May be increased also with valvular regurgitation.

Table 16 Echocardiographic and Doppler parameters used in grading severity of prosthetic tricuspid valve regurgitation

Parameter	Mild	Moderate	Severe
Valve structure	Usually normal	Abnormal or valve dehiscence	Abnormal or valve dehiscence
Jet area by color Doppler, central jets only (cm^2)	<5	5-10	>10
VC width (cm)*	Not defined	Not defined, but <0.7	>0.7
Jet density and contour by CW Doppler	Incomplete or faint, parabolic	Dense, variable contour	Dense with early peaking
Doppler systolic hepatic flow	Normal or blunted	Blunted	Holosystolic reversal
Right atrium, right ventricle, IVC	Normal†	Dilated	Markedly dilated

IVC, Inferior vena cava; *VC*, vena contracta.
Adapted from Zoghbi et al.[16]
*For a valvular TR jet, extrapolated from native TR; unknown cutoffs for paravalvular TR.
†If no other reason for dilatation.

Table 5 Grading the severity of TR

Parameters	Mild	Moderate	Severe
Qualitative			
Tricuspid valve morphology	Normal/abnormal	Normal/abnormal	Abnormal/flail/large coaptation defect
Colour flow TR jet[a]	Small, central	Intermediate	Very large central jet or eccentric wall impinging jet
CW signal of TR jet	Faint/Parabolic	Dense/Parabolic	Dense/Triangular with early peaking (peak <2 m/s in massive TI
Semi-quantitative			
VC width (mm)[a]	Not defined	<7	≥7
PISA radius (mm)[b]	≤5	6–9	>9
Hepatic vein flow[c]	Systolic dominance	Systolic blunting	Systolic flow reversal
Tricuspid inflow	Normal	Normal	*E* wave dominant (≥1 cm/s)[d]
Quantitative			
EROA (mm^2)	Not defined	Not defined	≥40
R Vol (mL)	Not defined	Not defined	≥45
+ RA/RV/IVC dimension[e]			