Table 4 Qualitative and quantitative parameters useful in grading aortic regurgitation severity

	Mild	Moderate		Severe
Structural parameters				
LA size	Normal*	Normal or dilated		Usually dilated**
Aortic leaflets	Normal or abnormal	Normal or abnormal		Abnormal/flail, or wide coaptation defect
Doppler parameters				
Jet width in LVOT –Color Flow[ξ]	Small in central jets	Intermediate		Large in central jets; variable in eccentric jets
Jet density–CW	Incomplete or faint	Dense		Dense
Jet deceleration rate –CW (PHT, ms)[ψ]	Slow > 500	Medium 500-200		Steep < 200
Diastolic flow reversal in descending aorta –PW	Brief, early diastolic reversal	Intermediate		Prominent holodiastolic reversal
Quantitative parameters[φ]				
VC width, cm[ξ]	< 0.3	0.3-0.60		> 0.6
Jet width/LVOT width, %[ξ]	< 25	25-45	46-64	≥ 65
Jet CSA/LVOT CSA, %[ξ]	< 5	5-20	21-59	≥ 60
R Vol, ml/beat	< 30	30-44	45-59	≥ 60
RF, %	< 30	30-39	40-49	≥ 50
EROA, cm^2	< 0.10	0.10-0.19	0.20-0.29	≥ 0.30

AR, Aortic regurgitation; *CSA*, cross sectional area; *CW*, continuous wave Doppler; *EROA*, effective regurgitant orifice area; *LV*, left ventricle; *LVOT*, left ventricular outflow tract; *PHT*, pressure half-time; *PW*, pulsed wave Doppler; *R Vol*, regurgitant volume; *RF*, regurgitant fraction; *VC*, vena contracta.
* Unless there are other reasons for LV dilation. Normal 2D measurements: LV minor axis ≤ 2.8 cm/m^2, LV end-diastolic volume ≤ 82 ml/m^2 (2).
** Exception: would be acute AR, in which chambers have not had time to dilate.
[ξ] At a Nyquist limit of 50–60 cm/s.
[ψ] PHT is shortened with increasing LV diastolic pressure and vasodilator therapy, and may be lengthened in chronic adaptation to severe AR
[φ] Quantitative parameters can sub-classify the moderate regurgitation group into mild-to-moderate and moderate-to-severe regurgitation as shown.

convergence region by transthoracic echo is performed from the apical, para-apical views, or the upper right-sternal border, with images zoomed on the valvular and supra-valvular region. The Nyquist limit is adjusted to obtain a rounded and measurable flow convergence zone and the aliasing radius is measured from the stop frame with the largest observable PISA. CW Doppler recording of the regurgitant peak velocity and velocity time integral allows calculation of the EROA and regurgitant volume. This method has been shown to provide accurate quantitation of AR.[63] However, it is feasible in a lower percentage of patients compared to MR due to interposition of valve tissue (apical views) and difficulty in obtaining high quality images of the flow convergence region. Another pitfall is related to the timing of measurement of the flow convergence radius, which should be in early diastole, closest to the peak regurgitant velocity. Furthermore, ascending aortic aneurysms, which deform the valvular plane, may lead to underestimation of AR by this method.[63] The thresholds for severe AR are an EROA ≥ 0.30 cm^2 and a regurgitant volume ≥ 60 ml.

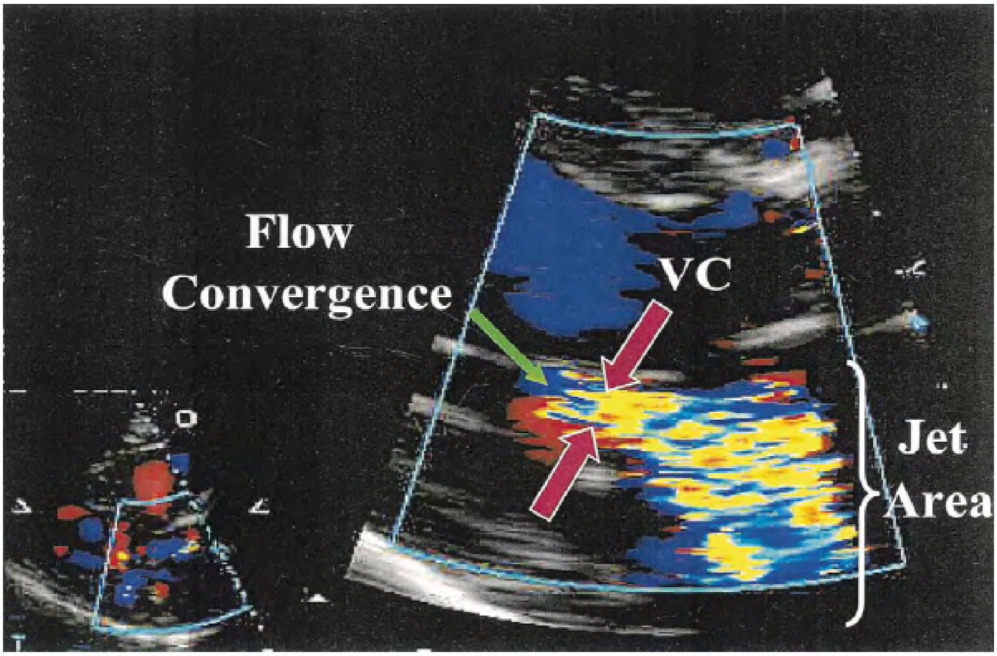

Figure 1 Color flow recording of a mitral regurgitation jet obtained from a zoomed view in the parasternal long axis depicting the 3 components of the regurgitant jet: flow convergence, vena contracta (*VC*), and jet area in the left atrium. Measurement of the vena contracta is shown between the *red arrows*.

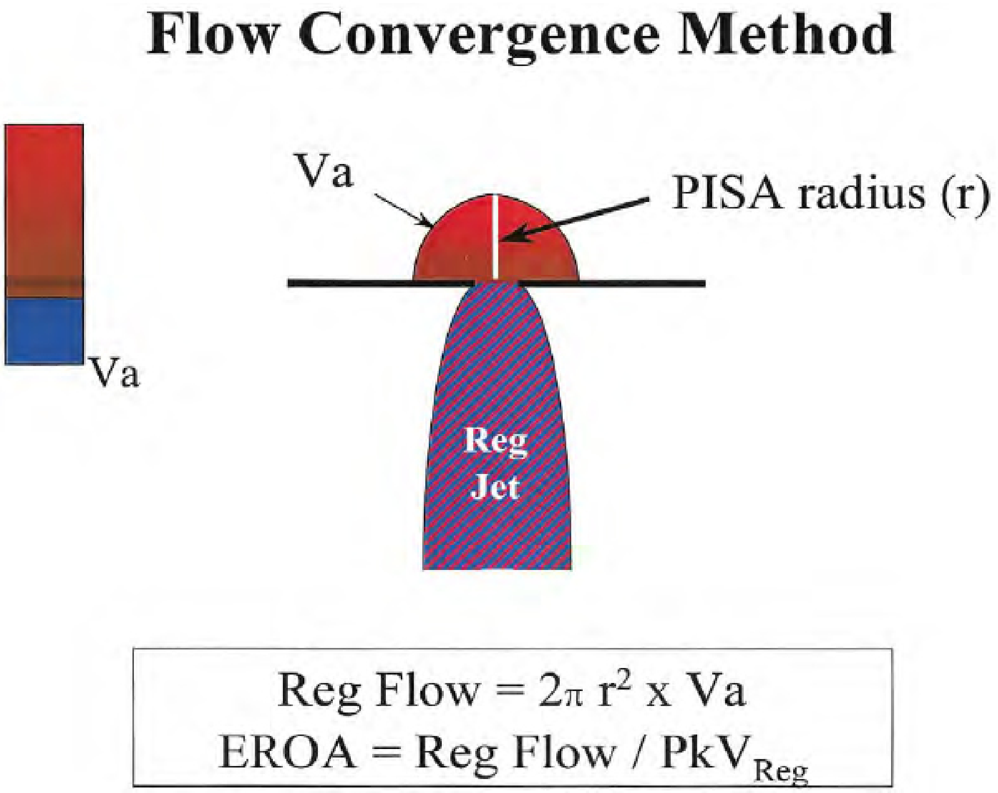

Figure 2 Schematic depiction of the flow convergence or proximal isovelocity surface area (*PISA*) method for quantitating valvular regurgitation. *Va* is the velocity at which aliasing occurs in the flow convergence towards the regurgitant orifice. PkV_{Reg}, Peak velocity of the regurgitant jet, determined by continuous wave Doppler. *Reg flow*, regurgitant flow; *EROA*, effective regurgitant orifice area; *Reg jet*, regurgitation jet.