

LONDON HEALTH SCIENCES CENTRE ECHOCARDIOGRAPHY LAB

ASE Guidelines and Standards

The following tables were taken from the American Society of Echocardiography Guidelines and Standards as a reference for Cardiac Sonographers. You can find this information on the ASE website <http://asecho.org/guidelines/guidelines-standards/>

Left Ventricular size, function and mass

Supplemental Table 3 Normal ranges and severity partition cutoff values for 2DE-derived LV size, function and mass

	Male				Female			
	Normal range	Mildly abnormal	Moderately abnormal	Severely abnormal	Normal range	Mildly abnormal	Moderately abnormal	Severely abnormal
LV dimension								
LV diastolic diameter (cm)	4.2-5.8	5.9-6.3	6.4-6.8	>6.8	3.8-5.2	5.3-5.6	5.7-6.1	>6.1
LV diastolic diameter/BSA (cm/m ²)	2.2-3.0	3.1-3.3	3.4-3.6	>3.6	2.3-3.1	3.2-3.4	3.5-3.7	>3.7
LV systolic diameter (cm)	2.5-4.0	4.1-4.3	4.4-4.5	>4.5	2.2-3.5	3.6-3.8	3.9-4.1	>4.1
LV systolic diameter/BSA (cm/m ²)	1.3-2.1	2.2-2.3	2.4-2.5	>2.5	1.3-2.1	2.2-2.3	2.4-2.6	>2.6
LV volume								
LV diastolic volume (mL)	62-150	151-174	175-200	>200	46-106	107-120	121-130	>130
LV diastolic volume/BSA (mL/m ²)	34-74	75-89	90-100	>100	29-61	62-70	71-80	>80
LV systolic volume (mL)	21-61	62-73	74-85	>85	14-42	43-55	56-67	>67
LV systolic volume/BSA (mL/m ²)	11-31	32-38	39-45	>45	8-24	25-32	33-40	>40
LV function								
LV EF (%)	52-72	41-51	30-40	<30	54-74	41-53	30-40	<30
LV mass by linear method								
Septal wall thickness (cm)	0.6-1.0	1.1-1.3	1.4-1.6	>1.6	0.6-0.9	1.0-1.2	1.3-1.5	>1.5
Posterior wall thickness (cm)	0.6-1.0	1.1-1.3	1.4-1.6	>1.6	0.6-0.9	1.0-1.2	1.3-1.5	>1.5
LV mass (g)	88-224	225-258	259-292	>292	67-162	163-186	187-210	>210
LV mass/BSA (g/m ²)	49-115	116-131	132-148	>148	43-85	96-108	109-121	>121
LV mass by 2D method								
LV mass (g)	96-200	201-227	228-254	>254	66-150	151-171	172-193	>193
LV mass/BSA (g/m ²)	50-102	103-116	117-130	>130	44-88	89-100	101-112	>112

Recommendations for Chamber Quantification by Echocardiography in Adults, JASE, January 2015

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Left Ventricular Regional Wall Segments

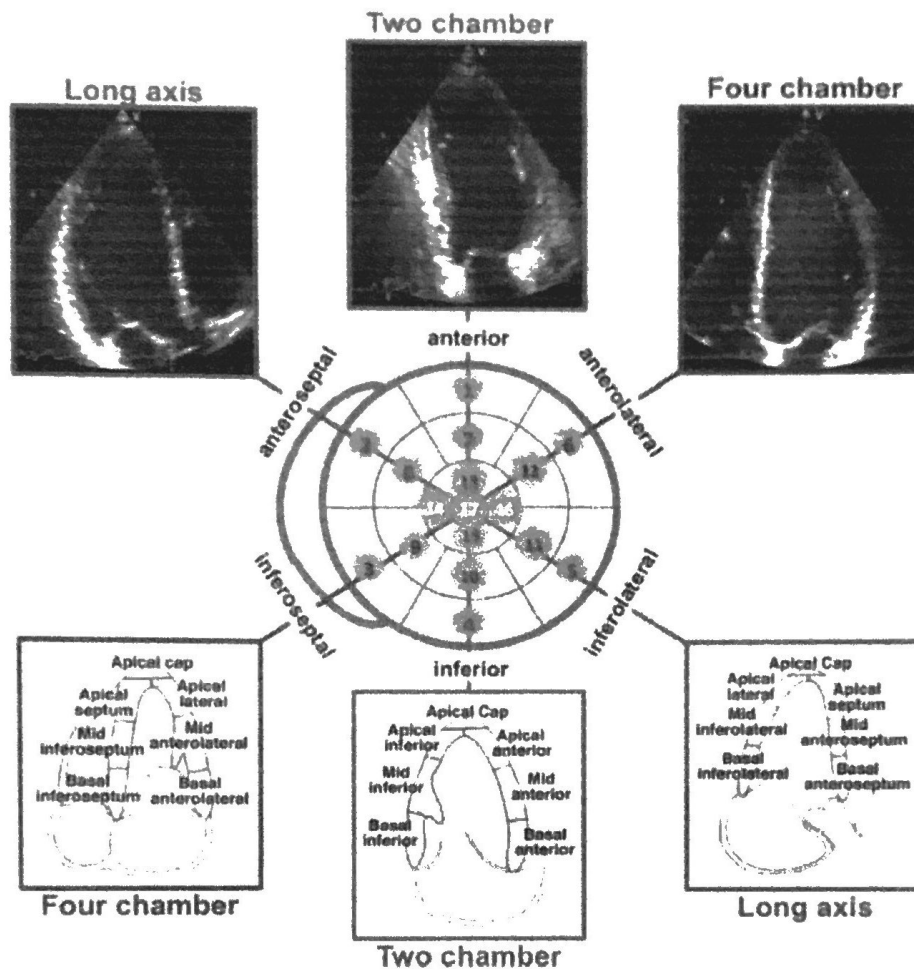


Figure 4 Orientation of apical four-chamber (A4C), apical two-chamber (A2C), and apical long-axis (ALX) views in relation to the bull's-eye display of the LV segments (center). Top panels show actual images, and bottom panels schematically depict the LV wall segments in each view.

Recommendations for Chamber Quantification by Echocardiography in Adults, JASE, January 2015

Left Atrial dimensions

Table 4 Normal ranges and severity partition cutoff values for 2DE-derived LV EF and LA volume

	Male				Female			
	Normal range	Mildly abnormal	Moderately abnormal	Severely abnormal	Normal range	Mildly abnormal	Moderately abnormal	Severely abnormal
LV EF (%)	52-72	41-51	30-40	<30	54-74	41-53	30-40	<30
Maximum LA volume/BSA (mL/m ²)	16-34	35-41	42-48	>48	16-34	35-41	42-48	>48

Recommendations for Chamber Quantification by Echocardiography in Adults, JASE, January 2015

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Right Ventricular size and function

Table 8 Normal values for RV chamber size

Parameter	Mean ± SD	Normal range
RV basal diameter (mm)	33 ± 4	25-41
RV mid diameter (mm)	27 ± 4	19-35
RV longitudinal diameter (mm)	71 ± 6	59-83
RVOT PLAX diameter (mm)	25 ± 2.5	20-30
RVOT proximal diameter (mm)	28 ± 3.5	21-35
RVOT distal diameter (mm)	22 ± 2.5	17-27
RV wall thickness (mm)	3 ± 1	1-5
RVOT EDA (cm ²)		
Men	17 ± 3.5	10-24
Women	14 ± 3	8-20
RV EDA indexed to BSA (cm ² /m ²)		
Men	8.8 ± 1.9	5-12.6
Women	8.0 ± 1.75	4.5-11.5
RV ESA (cm ²)		
Men	9 ± 3	3-15
Women	7 ± 2	3-11
RV ESA indexed to BSA (cm ² /m ²)		
Men	4.7 ± 1.35	2.0-7.4
Women	4.0 ± 1.2	1.6-6.4
RV EDV indexed to BSA (mL/m ²)		
Men	61 ± 13	35-87
Women	53 ± 10.5	32-74
RV ESV indexed to BSA (mL/m ²)		
Men	27 ± 8.5	10-44
Women	22 ± 7	8-36

EDA, end-diastolic area; ESA, end-systolic area; PLAX, parasternal long-axis view; RVOT, RV outflow tract.

Recommendations for Chamber Quantification by Echocardiography in Adults, JASE, January 2015

Table 10 Normal values for parameters of RV function

Parameter	Mean ± SD	Abnormality threshold
TAPSE (mm)	24 ± 3.5	<17
Pulsed Doppler S wave (cm/sec)	14.1 ± 2.3	<9.5
Color Doppler S wave (cm/sec)	9.7 ± 1.85	<6.0
RV fractional area change (%)	49 ± 7	<35
RV free wall 2D strain* (%)	-29 ± 4.5	> -20 (<20 in magnitude with the negative sign)
RV 3D EF (%)	58 ± 6.5	<45
Pulsed Doppler MPI	0.26 ± 0.085	>0.43
Tissue Doppler MPI	0.38 ± 0.08	>0.54
E wave deceleration time (msec)	180 ± 31	<119 or >242
E/A	1.4 ± 0.3	<0.8 or >2.0
e'/a'	1.18 ± 0.33	<0.52
e'	14.0 ± 3.1	<7.8
E/e'	4.0 ± 1.0	>6.0

MPI, Myocardial performance index

*Limited data; values may vary depending on vendor and software version.

Recommendations for Chamber Quantification by Echocardiography in Adults, JASE, January 2015

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Right Atrial size

Table 13 Normal RA size obtained from 2D echocardiographic studies

	Women	Men
RA minor axis dimension (cm/m ²)	1.9 ± 0.3	1.9 ± 0.3
RA major axis dimension (cm/m ²)	2.5 ± 0.3	2.4 ± 0.3
2D echocardiographic RA volume (mL/m ²)	21 ± 6	25 ± 7

Data are expressed as mean ± SD.

Recommendations for Chamber Quantification by Echocardiography in Adults, JASE, January 2015

Aortic Dimensions

Table 14 Aortic root dimensions in normal adults

Aortic Root	Absolute values (cm)		Indexed values (cm/m ²)	
	Men	Women	Men	Women
Annulus	2.6 ± 0.3	2.3 ± 0.2	1.3 ± 0.1	1.3 ± 0.1
Sinuses of Valsalva	3.4 ± 0.3	3.0 ± 0.3	1.7 ± 0.2	1.8 ± 0.2
Sinotubular junction	2.9 ± 0.3	2.6 ± 0.3	1.5 ± 0.2	1.5 ± 0.2
Proximal ascending aorta	3.0 ± 0.4	2.7 ± 0.4	1.5 ± 0.2	1.6 ± 0.3

Adapted from Roman et al.^{1,2,3} and Hiratzka et al.^{4,5}

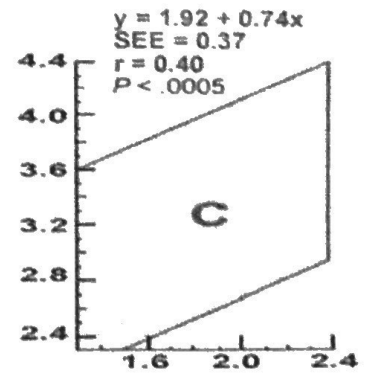
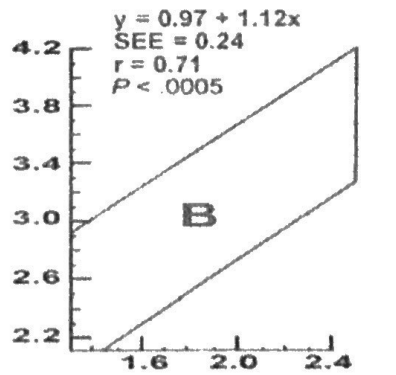
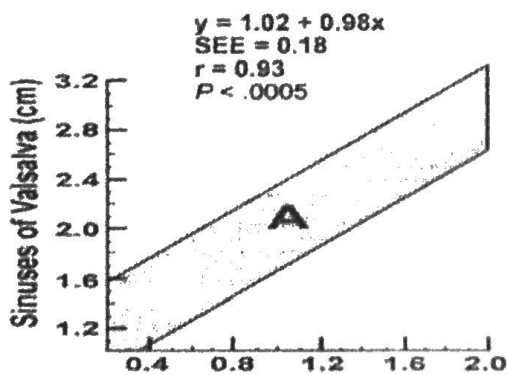
Recommendations for Chamber Quantification by Echocardiography in Adults, JASE, January 2015

	Normal Range
S of V	Men 2.8-4.0 cm
S of V	Women 2.4-3.6 cm
Ascending Aorta	Men 2.2-3.8 cm
Ascending Aorta	Women 1.9-3.5 cm

Children and adolescents

Adults 20-39 years

Adults >40 years



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IVC and RAP

IVC < 2.1 cm, >50% collapse with sniffing	3 mmHg (0-5mmHg)
IVC < 2.1 cm, <50% collapse with sniffing IVC >2.1 cm, >50% collapse with sniffing	8 mmHg (5-10 mmHg)
IVC >2.1 cm, <50% collapse with sniffing	15 mmHg (10-20 mmHg)

Recommendations for Chamber Quantification by Echocardiography in Adults, JASE, January 2015

Aortic Stenosis

Table 3 Recommendations for classification of AS severity

	Aortic sclerosis	Mild	Moderate	Severe
Aortic jet velocity (m/s)	≤ 2.5 m/s	2.6-2.9	3.0-4.0	>4.0
Mean gradient (mmHg)	-	<20 (<30 ^a)	20-40 ^b (30-50 ^a)	>40 ^b (>50 ^a)
AVA (cm ²)	-	>1.5	1.0-1.5	<1.0
Indexed AVA (cm ² /m ²)	-	>0.85	0.60-0.85	<0.6
Velocity ratio	-	>0.50	0.25-0.50	<0.25

^aESC Guidelines.

^bAHA/ACC Guidelines.

Echocardiographic Assessment of Valve Stenosis: EAE/ASE Recommendations for Clinical Practice, JASE, January 2009

Mitral Stenosis

Table 9 Recommendations for classification of mitral stenosis severity

	Mild	Moderate	Severe
Specific findings			
Valve area (cm ²)	>1.5	1.0-1.5	<1.0
Supportive findings			
Mean gradient (mmHg) ^a	<5	5-10	>10
Pulmonary artery pressure (mmHg)	<30	30-50	>50

^aAt heart rates between 60 and 80 bpm and in sinus rhythm.

Echocardiographic Assessment of Valve Stenosis: EAE/ASE Recommendations for Clinical Practice, JASE, January 2009

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Tricuspid Stenosis

Table 10 Findings indicative of haemodynamically significant tricuspid stenosis

Specific findings	
Mean pressure gradient	≥ 5 mmHg
Inflow time-velocity integral	< 60 cm
$T_{1/2}$	> 190 ms
Valve area by continuity equation*	≤ 1 cm ²
Supportive findings	
Enlarged right atrium	\geq moderate
Dilated inferior vena cava	

*Stroke volume derived from left or right ventricular outflow. In the presence of more than mild TR, the derived valve area will be underestimated. Nevertheless, a value ≤ 1 cm² implies a significant haemodynamic burden imposed by the combined lesion.

Echocardiographic Assessment of Valve Stenosis: EAE/ASE Recommendations for Clinical Practice, JASE, January 2009

Pulmonary Stenosis

Table 11 Grading of pulmonary stenosis

	Mild	Moderate	Severe
Peak velocity (m/s)	< 3	3-4	> 4
Peak gradient (mmHg)	< 36	36-64	> 64

Echocardiographic Assessment of Valve Stenosis: EAE/ASE Recommendations for Clinical Practice, JASE, January 2009

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Aortic Prosthesis

Table 5 Doppler parameters of prosthetic aortic valve function in mechanical and stented biologic valves*

Parameter	Normal	Possible stenosis	Suggests significant stenosis
Peak velocity (m/s) [†]	<3	3-4	>4
Mean gradient (mm Hg) [†]	<20	20-35	>35
DVI	≥0.30	0.29-0.25	<0.25
EOA (cm ²)	>1.2	1.2-0.8	<0.8
Contour of the jet velocity through the PrAV	Triangular, early peaking	Triangular to intermediate	Rounded, symmetrical contour
AT (ms)	<80	80-100	>100

PrAV, Prosthetic aortic valve.

*In conditions of normal or near normal stroke volume (50-70 mL) through the aortic valve.

†These parameters are more affected by flow, including concomitant AR.

Recommendations For Evaluation of Prosthetic Valves with Two-Dimensional and Doppler Echocardiography. JASE, September 2009

Mitral Prosthesis

Table 8 Doppler parameters of prosthetic mitral valve function

	Normal*	Possible stenosis [‡]	Suggests significant stenosis* [‡]
Peak velocity (m/s) ^{† §}	<1.9	1.9-2.5	≥2.5
Mean gradient (mm Hg) ^{† §}	≤5	6-10	>10
VTI _{PrMV} /VTI _{LVO} ^{† §}	<2.2	2.2-2.5	>2.5
EOA (cm ²)	≥2.0	1-2	<1
PHT (ms)	<130	130-200	>200

PHT, Pressure half-time; PrMV, prosthetic mitral valve.

*Best specificity for normality or abnormality is seen if the majority of the parameters listed are normal or abnormal, respectively.

†Slightly higher cutoff values than shown may be seen in some bioprosthetic valves.

‡Values of the parameters should prompt a closer evaluation of valve function and/or other considerations such as increased flow, increased heart rate, or PPM.

§These parameters are also abnormal in the presence of significant prosthetic MR.

Recommendations For Evaluation of Prosthetic Valves with Two-Dimensional and Doppler Echocardiography. JASE, September 2009

Tricuspid Prosthesis

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.

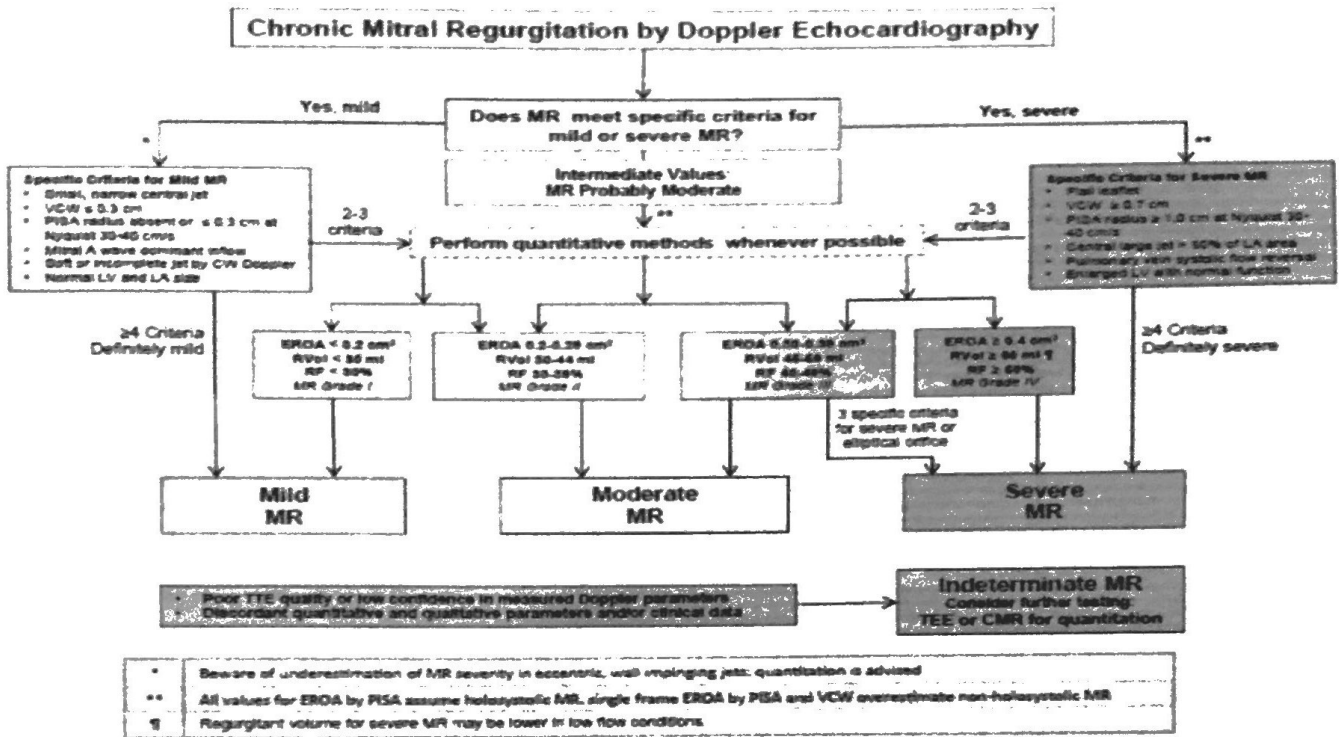
*Because of respiratory variation, average ≥5 cycles.

†May be increased also with valvular regurgitation.

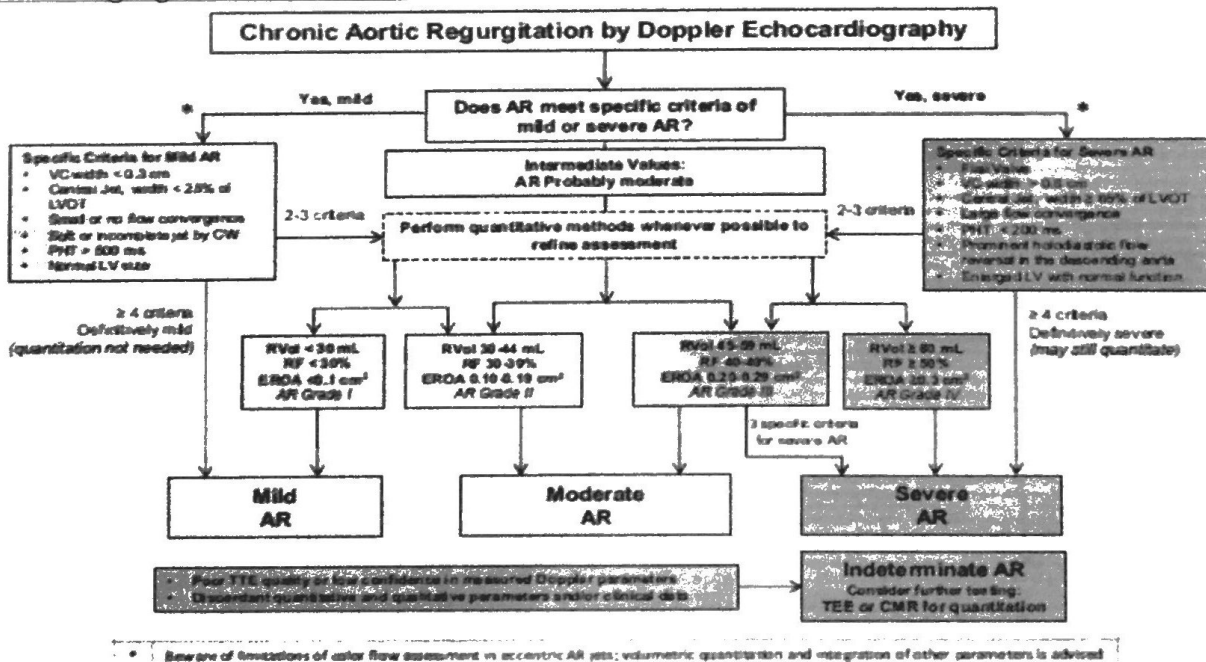
Recommendations For Evaluation of Prosthetic Valves with Two-Dimensional and Doppler Echocardiography. JASE, September 2009

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Mitral Regurgitation Evaluation



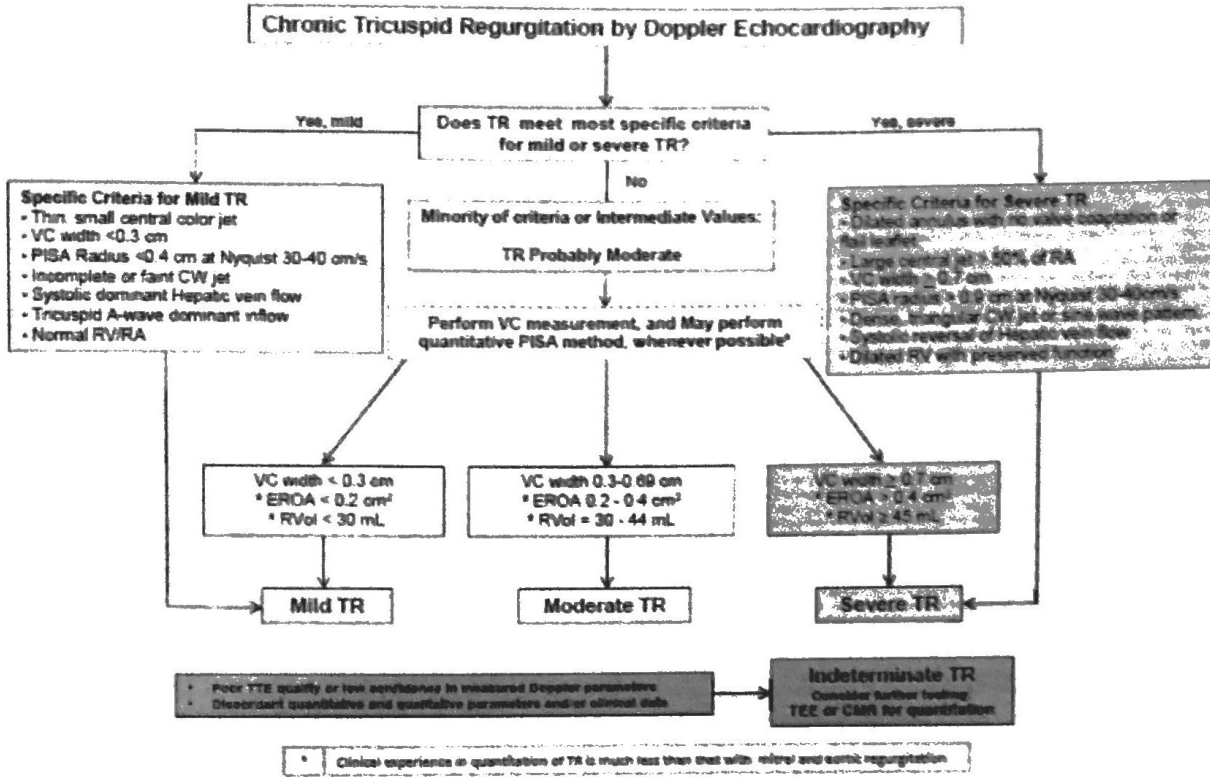
Aortic Regurgitation Evaluation



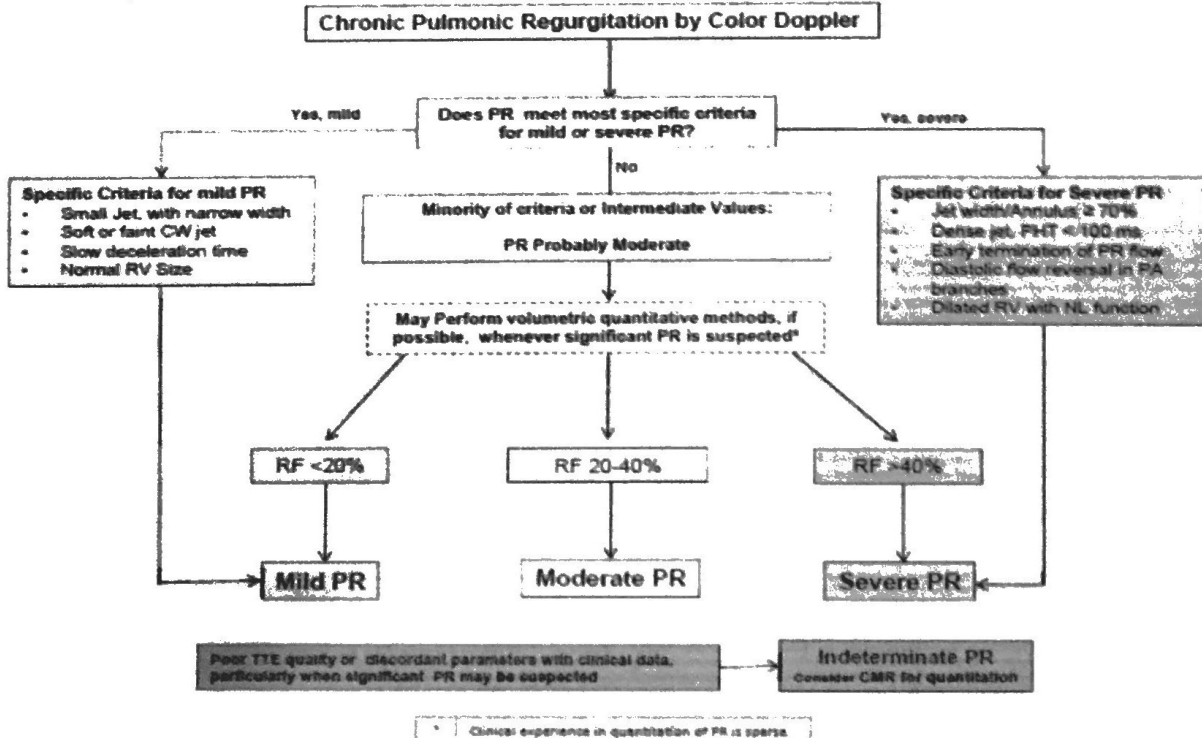
Recommendations for Noninvasive Evaluation of Native Valvular Regurgitation, JASE, April 2017

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Tricuspid Regurgitation Evaluation



Pulmonary Regurgitation Evaluation

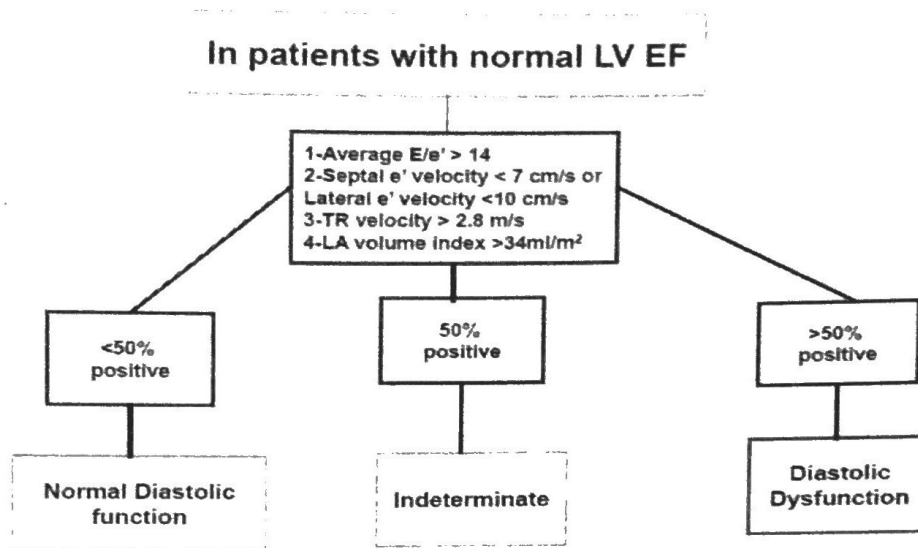


Recommendations for Noninvasive Evaluation of Native Valvular Regurgitation, JASE, April 2017

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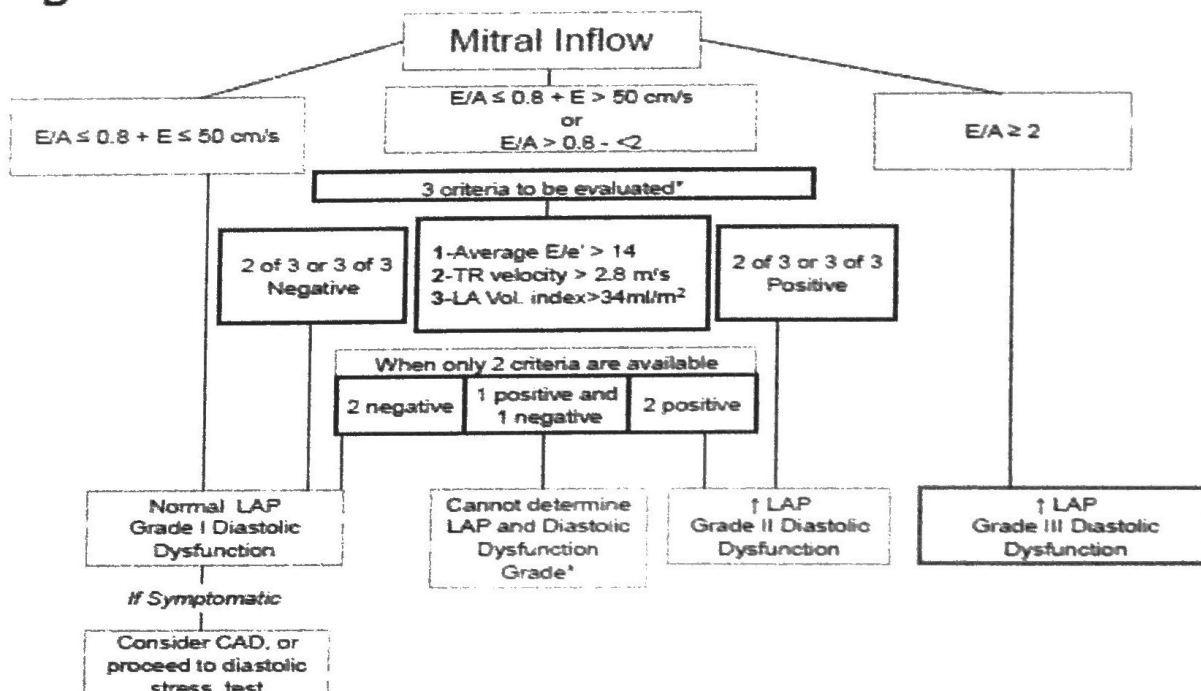
Diagnosis of LV DIASOLIC DYSFUNCTION in subjects with NORMAL LVEF

A



Estimation of LV FILLING PRESSURES and GRADING OF LV DIASTOLIC DYSFUNCTION in patients with Depressed LVEF and patients with Myocardial Disease and Normal LVEF

B



(* : LAP indeterminate if only 1 of 3 parameters available. Pulmonary vein S/D ratio < 1 applicable to conclude elevated LAP in patients with depressed LV EF)

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References:

- Recommendations For Evaluation of Prosthetic Valves with Two-Dimensional and Doppler Echocardiography, JASE, September 2009**
- ASE/EAE Recommendations for the Evaluation of Left Ventricular Diastolic Function by Echocardiography, JASE, February 2009**
- Echocardiographic Assessment of Valve Stenosis: EAE/ASE Recommendations for Clinical Practice, JASE, January 2009**
- ASE Recommendations for Chamber Quantification, JASE, December 2005**
- Recommendations for Chamber Quantification by Echocardiography in Adults, JASE, January 2015**
- Recommendations for Evaluation of the Severity of Native Valvular Regurgitation with Two-Dimensional and Doppler Echocardiography, JASE, July 2003**
- Recommendations for Quantification of Doppler Echocardiography, JASE, February 2009**
- Recommendations for the Evaluation of Left Ventricular Diastolic Function by Echocardiography, JASE, April 2016**
- Recommendations for Noninvasive Evaluation of Native Valvular Regurgitation, JASE, April 2017**