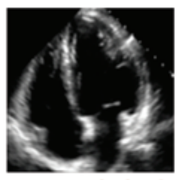
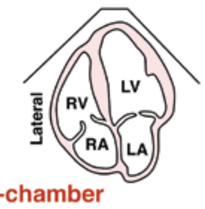
Guidelines for Chamber Quantification of the Right Heart

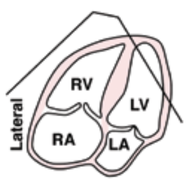
ASE American Society of Echocardiography

RV Views

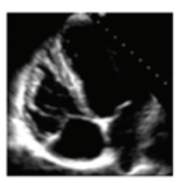


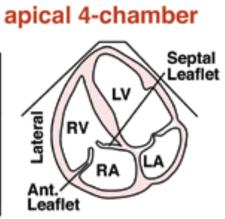


Apical 4-chamber

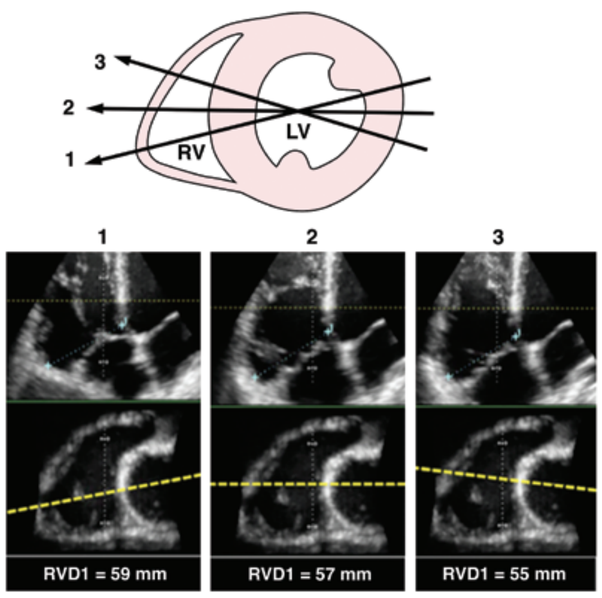


RV modified apical 4-chamber





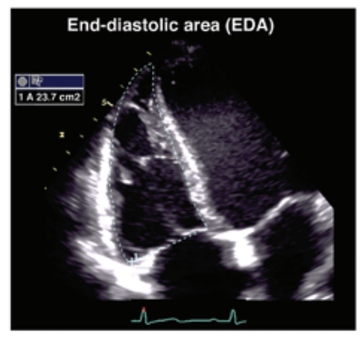
RV focused apical 4-chamber



RV Area

Manual tracing of RV endocardial border from the lateral tricuspid annulus along the free wall to the apex and back to medial tricuspid annulus, along the interventricular septum at end-diastole and at end-systole.

Trabeculations, papillary muscles and moderator band are included in the cavity area.

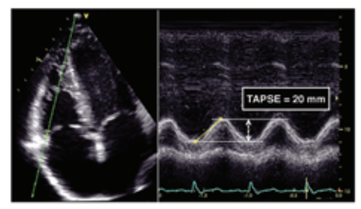


RV Longitudinal Systolic Function

TAPSE

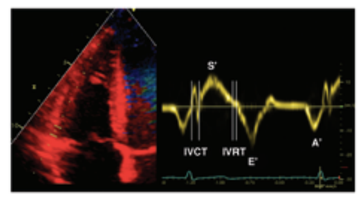
Tricuspid annular peak systolic excursion by M-mode (mm), measured between end-diastole and peak systole.

Proper alignment of M-mode cursor with the direction of RV longitudinal excursion should be achieved from the apical approach.



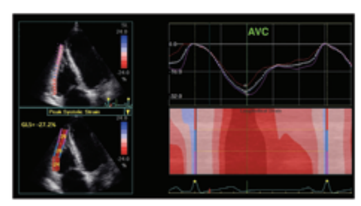
Pulsed tissue Doppler S wave

Peak systolic velocity of the tricuspid annulus (cm/s), obtained from the apical approach, in the view that achieves parallel alignment of Doppler beam with RV free-wall longitudinal excursion.

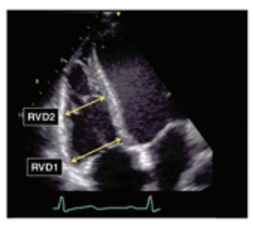


Global longitudinal free-wall strain

Peak value of 2D longitudinal speckle tracking derived strain (%), averaged over the 3 segments of the RV free wall in RV-focused apical 4-chamber view.



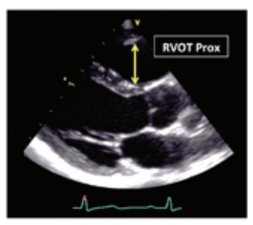
RV Linear Dimensions



Inflow

Basal RV linear diameter (RVD1) = maximal transversal dimension in the basal one third of RV inflow at end-diastole in the RV-focused view.

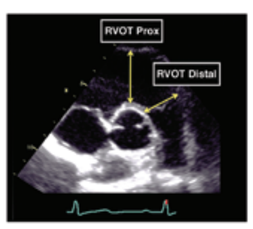
Mid-cavity RV linear diameter (RVD2) = transversal RV dimension in the middle third of RV inflow, approximately halfway between the maximal basal diameter and the apex, at the level of papillary muscles at end-diastole.



Outflow

Proximal RV outflow diameter (RVOT Prox) = linear dimension measured from the anterior RV wall to the inter-ventricular septal-aortic junction (in parasternal long-axis view) or to the aortic valve (in parasternal short-axis) at end-diastole.

Distal RV outflow diameter (RVOT Distal) = linear transversal dimension measured just proximal to the pulmonary valve at end-diastole.



RV Size

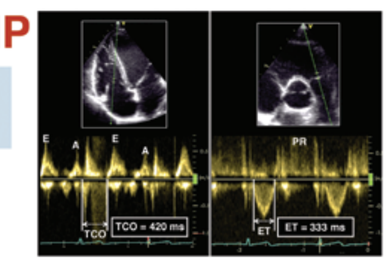
Parameter	Mean ± SD	Normal range
RV basal diameter (mm)	33 ± 4	25 - 41
RV mid-cavity diameter (mm)	27 ± 4	19 - 35
RVOT PLAX proximal diameter (mm)	25 ± 2.5	20 - 30
RVOT SAX proximal diameter (mm)	28 ± 3.5	21 - 35
RVOT SAX distal diameter (mm)	22 ± 2.5	17 - 27
RV wall thickness (mm)	3 ± 1	1 - 5
RV EDA (cm²)		
Men	17 ± 3.5	10 - 24
Women	14 ± 3	8 - 20
RV EDA indexed to BSA (cm²/m²)		
Men	8.8 ± 1.9	5 - 12.6
Women	8.0 ± 1.75	4.5 - 11.5
RV ESA (cm²)		
Men	9 ± 3	3 - 15
Women	7 ± 2	3 - 11
RV ESA indexed to BSA (mL/m²)		
Men	4.7 ± 1.35	2.0 - 7.4
Women	4.0 ± 1.2	1.6 - 6.4
RV EDV indexed to BSA (mL/m²)		
Men	61 ± 13	35 - 87
Women	53 ± 10.5	32 - 74
RV ESV indexed to BSA (mL/m²)		
Men	27 ± 8.5	10 - 44
Women	22 ± 7	8 - 36

Abbreviations: BSA, body surface area; EDA, end-diastolic area; EDV, end-diastolic volume; ESA, end-systolic area; ESV, end-systolic volume; PLAX, parasternal long-axis view; RV, right ventricle; RVOT, right ventricular outflow tract.

RV Global Function

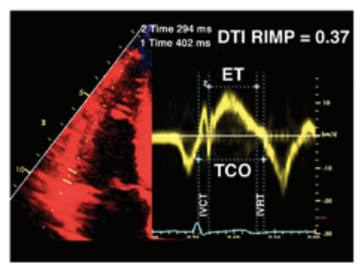
Pulsed Doppler RIMP

Right ventricular index of myocardial performance (Tei index):
RIMP = (TCO-ET)/ET

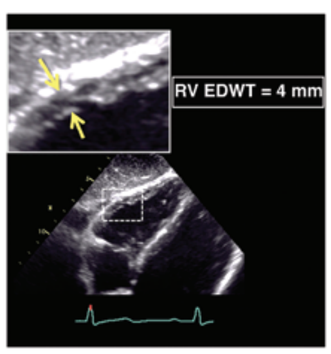


Tissue Doppler RIMP

Right ventricular index of myocardial performance by tissue Doppler:
RIMP=(IVRT+IVCT)/ET=(TCO-ET)/ET



RV Wall Thickness

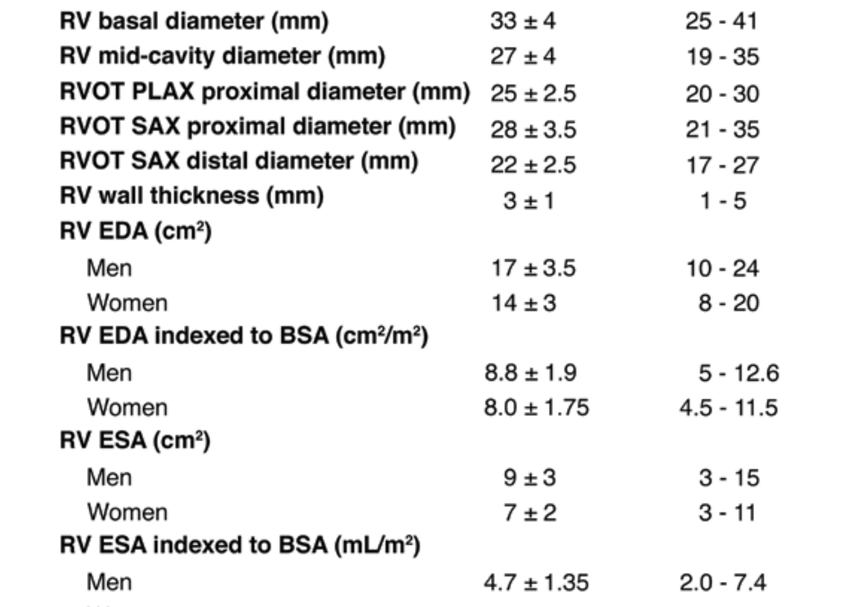


Linear measurement of RV free wall thickness (either by M-mode or 2D echocardiography) performed at end-diastole (EDWT), below the tricuspid annulus at a distance approximating the length of anterior tricuspid leaflet, when it is fully open and parallel to the RV free wall.

Trabeculae, papillary muscles and epicardial fat should be excluded.

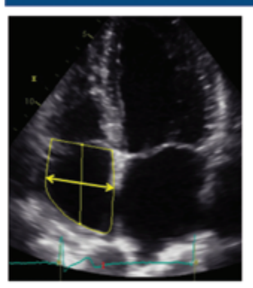
Zoomed imaging with focus on the RV mid-wall and respiratory maneuvers may improve endocardial border definition.

RV Segmentation and Perfusion



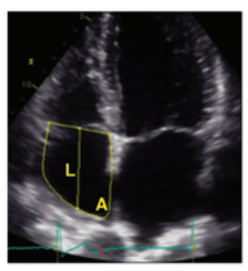
Abbreviations: Ao, aorta; CS, coronary sinus; LA, left atrium; LAD, left anterior descending artery; LV, left ventricle; PA, pulmonary artery; RA, right atrium; RCA, right coronary artery; RV, right ventricle; RVOT, right ventricular outflow tract.

RA Size



RA linear dimensions

The minor axis of the right atrium should be measured in the apical 4-chamber view as the distance between the lateral right atrial wall and inter-atrial septum, at the mid-atrial level defined by half of right atrial long axis.



RA volume

2D volume measurements are usually based on tracings of the blood-tissue interface in the apical 4-chamber view. At the tricuspid valve level, the contour is closed by connecting the two opposite sections of the tricuspid annulus with a straight line. Volumes can be computed by using either the single plane area-length or the disk summation technique.

	Women	Men
RA minor axis dimension (cm/m²)	1.9 ± 0.3	1.9 ± 0.3
RA major axis dimension (cm/m²)	2.5 ± 0.3	2.4 ± 0.3
2D right atrial volume (mL/m²)	21 ± 6	25 ± 7

RV Function

Parameter	Mean ± SD	Abnormality threshold
TAPSE (mm)	24 ± 3.5	<17
Pulsed DTI S wave (cm/s)	14.1 ± 2.3	<9.5
Color DTI S wave (cm/s)	9.7 ± 1.85	<6.0
RV fractional area change (%)	49 ± 7	<35
RV free wall 2D strain* (%)	-29 ± 4.5	>-20
RV 3D ejection fraction (%)	58 ± 6.5	<45
Pulsed Doppler RIMP	0.26 ± 0.085	>0.43
Tissue Doppler RIMP	0.38 ± 0.08	>0.54
E wave deceleration time (ms)	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

Abbreviations: E, early transtricuspid filling velocity; A, transtricuspid atrial contraction velocity; e' and a', early and late diastolic myocardial velocities by tissue Doppler; MPI, myocardial performance index; RV, right ventricle; S, systolic myocardial velocity by tissue Doppler; TAPSE, tricuspid annular plane systolic excursion. † Limited data; values may vary depending on vendor and software version.

Lang RM, Badano LP, Mor-Avi V, Afilalo J, Armstrong A, Ernande L, Flachskampf FA, Foster E, Goldstein SA, Kuznetsova T, Lancellotti P, Muraru D, Picard MH, Rietzschel ER, Rudski L, Spencer KT, Tsang W, and Voigt JU; Recommendations for Cardiac Chamber Quantification by Echocardiography in Adults: An Update from the American Society of Echocardiography and the European Association of Cardiovascular Imaging. J Am Soc Echocardiogr 2015; 28:1-39.

Poster ordering information and full text of ASE guideline documents available at: www.asecho.org

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