

Right Ventricular Echocardiography

Acute RV Dysfunction

- Increased RV:LV size ratio
- Septal dyskinesia
- **Tricuspid regurgitation (TR):**
 - From all cardiac views in which emitted sound waves are aligned roughly with TR flow ($\theta = 0^\circ$)
 - In these cases, $\cos 0^\circ = 1$, $\cos 20^\circ = 0.94$, $\cos 30^\circ = 0.87$. $\cos \theta$ is a factor in the equation for the Doppler shift. Stay within 20°.
 - **Caveat:** 25-405 will not have a jet using color Doppler
- Decreased tricuspid annular plane systolic excursion (TAPSE) < 17 mm
 - Associated with increased PE-related 30-day mortality
- Decreased S' < 9.5 cm/sec
- **Elevated pulmonary artery systolic pressure (PASP) > 35 mm Hg**
 - Correlates with right-heart catheterization
 - $\text{PASP} = \text{TRPG} + \text{RAP} = \Delta \text{PRV-RA} + \text{RAP} = (4 \times \text{TRVmax}^2) + \text{RAP}$
 - 1) Obtain TR using color Doppler. Use continuous wave Doppler to generate waveform. Obtain TRVmax^2 .
 - **Dilated, non-collapsible IVC:** 15 mm Hg
 - **Thin and collapsible:** 3 mm Hg
 - **In-between:** 8 mm Hg
- Decreased pulmonary artery acceleration time (PAAT) < 105 msec suggests elevated pulmonary artery pressure
- Pulmonary artery mid-systolic notching

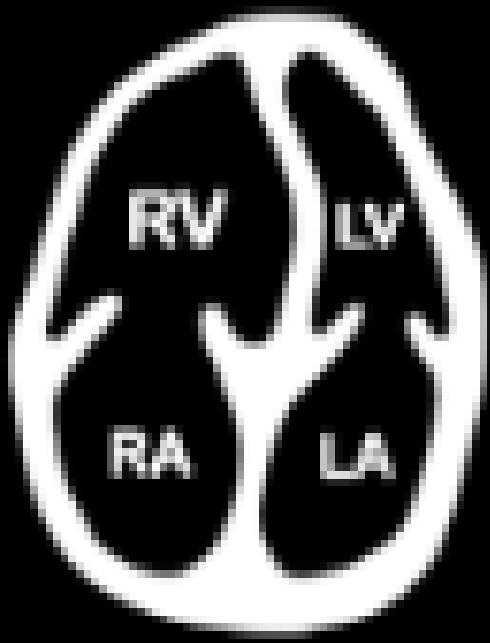
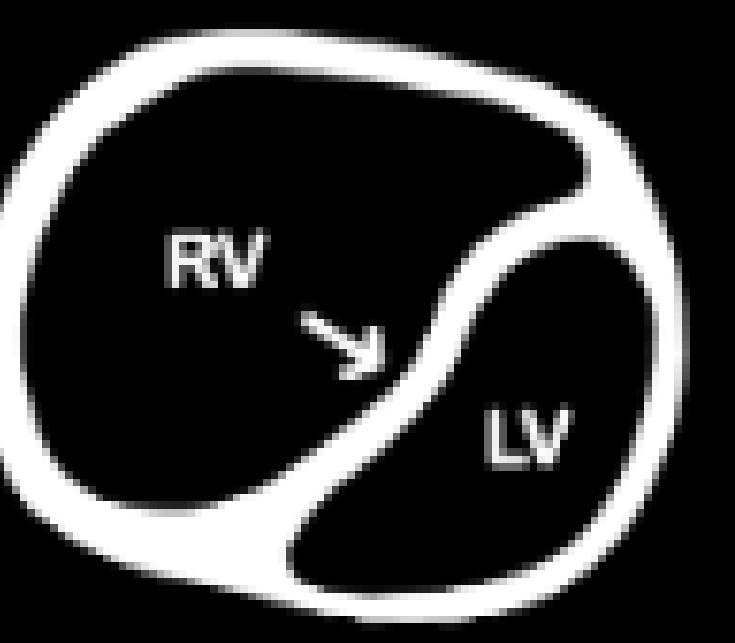
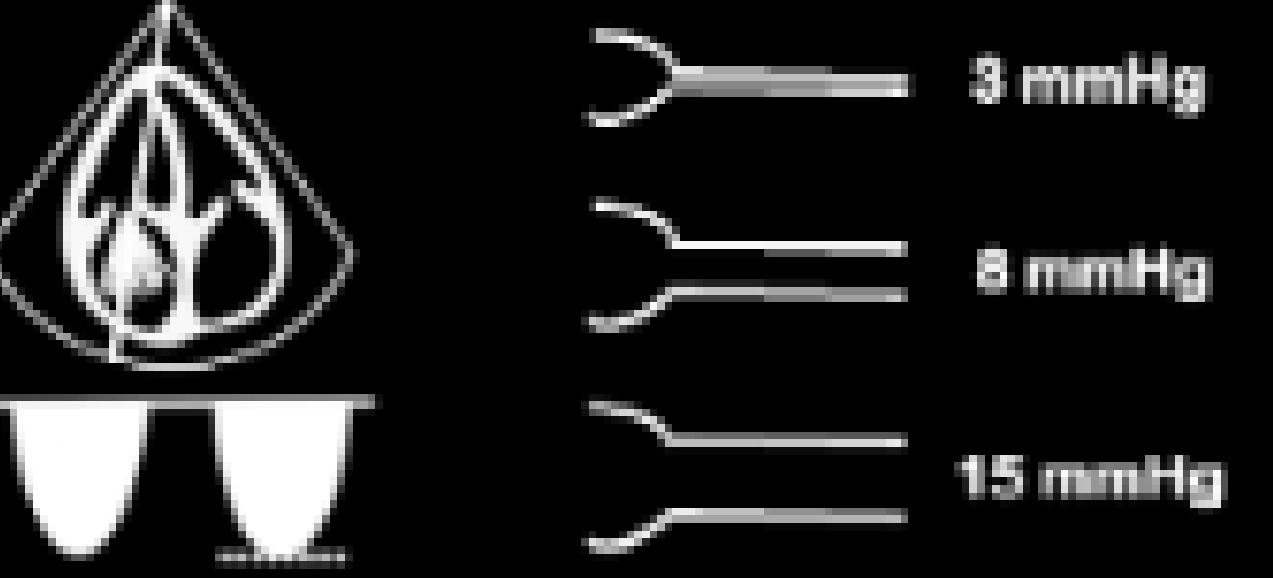
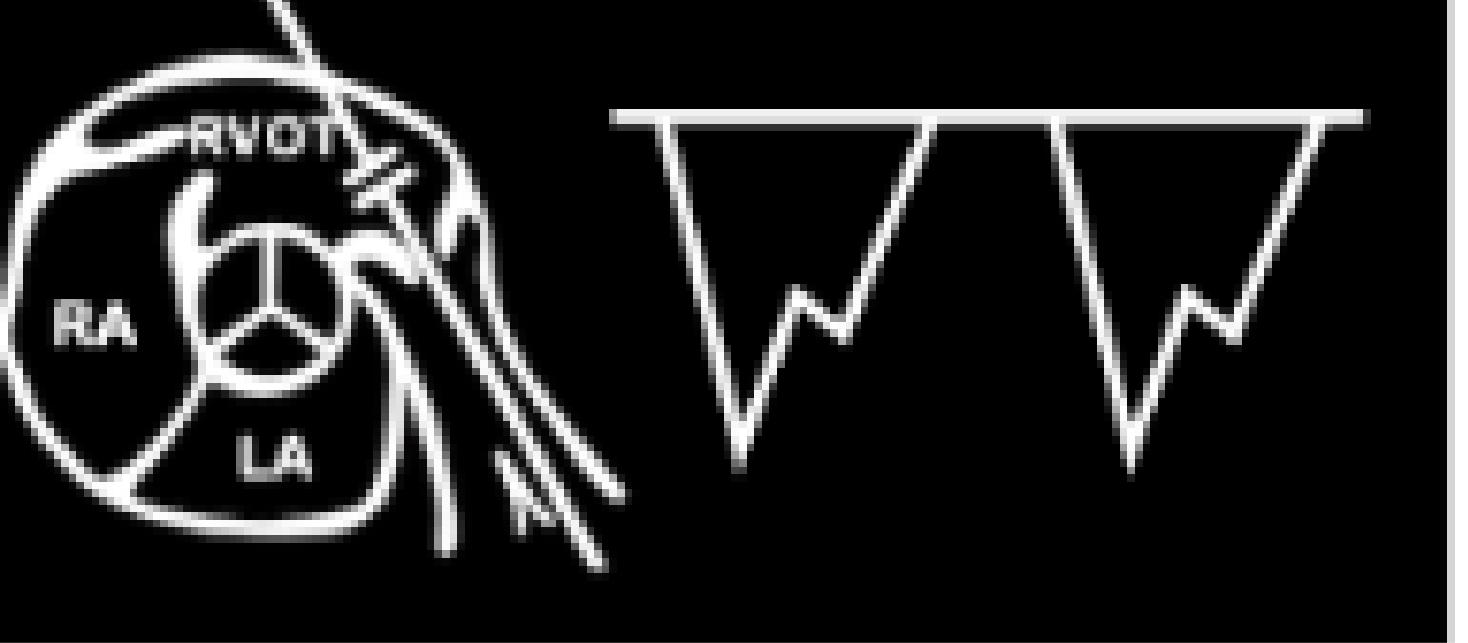
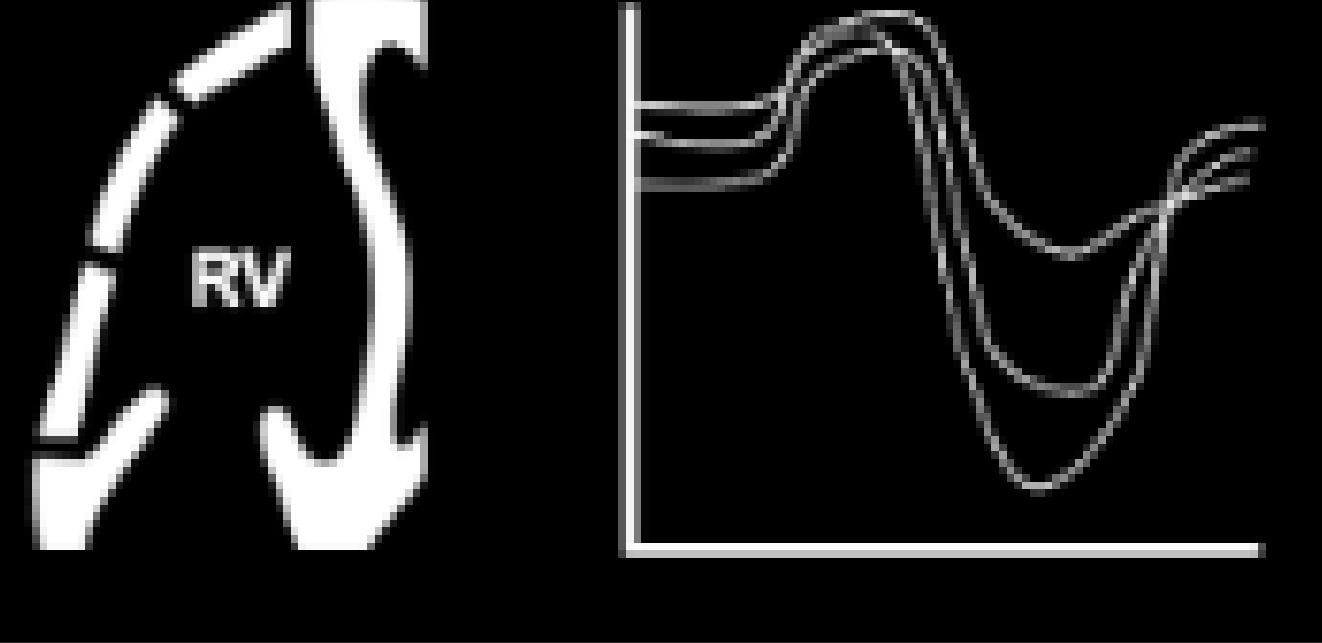
Acute vs Chronic RV Dysfunction

- Acute (eg, pulmonary embolism) versus chronic (eg, pulmonary hypertension) RV dysfunction
- Right heart thrombus: acute PE
- Right ventricular free wall thickness > 5 mm in SXLA (or PLAX) suggests **RV hypertrophy**; this is an adaptive change that decreased wall stress by the **law of Laplace**.

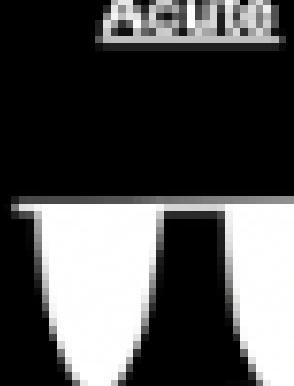
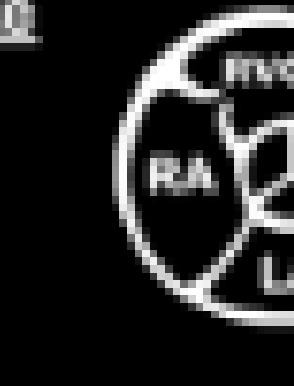
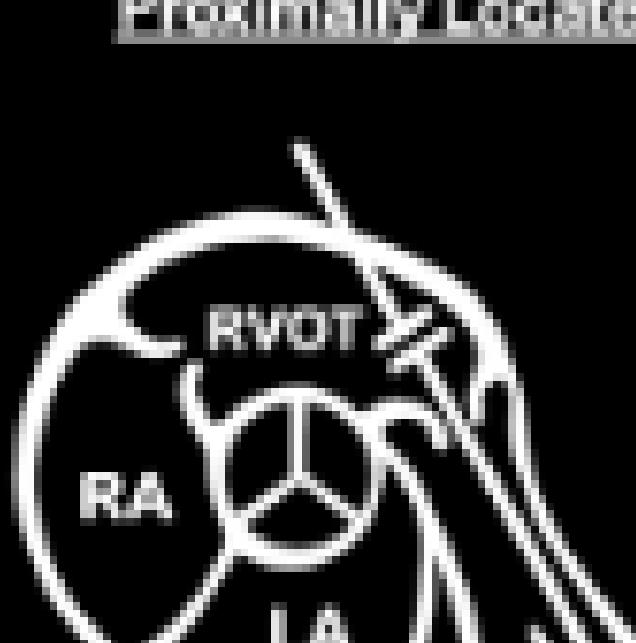
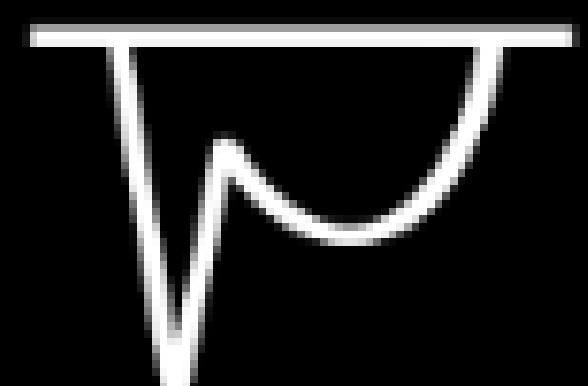
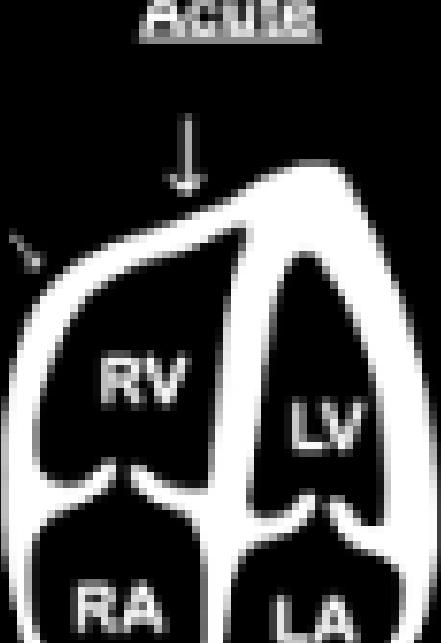
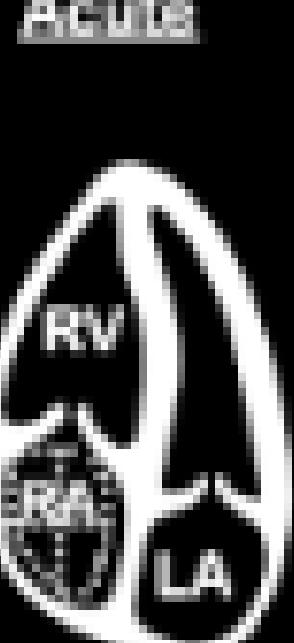
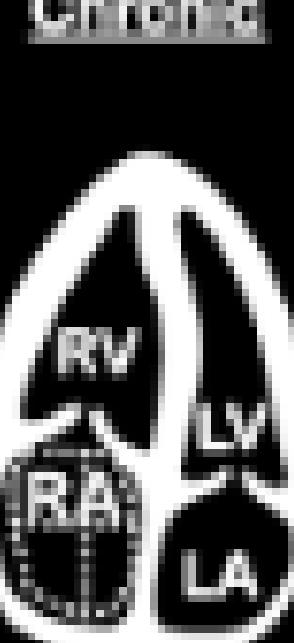
Acute vs Chronic RV Dysfunction (cont'd)

- TRPG \leq 46 mm Hg suggests **acute**, TRPG $>$ 46 suggests **chronic**; it is the RVH that leads to the increased Δ PRV-RA and can such high PASP.
- PAAT \leq 60-80 msec suggests **acute**, PAAT $<$ 105 msec suggests **chronic**; the increased PVR without the time for PA compliance leads to more rapid propagation of sound waves; PA waveform goes from rounded and dome-shaped (normal) to triangular (increased PA pressure).
- **60/60 sign: TRPG \leq 60 mm Hg and PAAT \leq 60 msec**
 - The original authors used TRPG, but since then people have manipulated this sign to use PASP. It's unclear which ones the test-writers would use.
- PA early-systolic notching suggests **acute PE**; the reflection site is more proximal with a **proximal PE**, so the sound waves are reflected back earlier; mid-systolic notching is thus more common with a peripherally located PE or PH, where the reflection site is more distal.
- **McConnell's sign suggests acute.**

Illustrations

Linda Qiu MD	RIGHT VENTRICULAR DYSFUNCTION		Stephen Alerhand MD
Increased RV:LV Size Ratio	Abnormal Septal Motion	McConnell's Sign	Tricuspid Regurgitation
			
Elevated Pulmonary Artery Systolic Pressure	Decreased TAPSE	Decreased S'	
 <p>PASP = $(4 \times \text{TRV}_{\text{max}}^2) + \text{RAP} > 35 \text{ mmHg}$</p>			
Pulmonary Artery Mid-Systolic Notching	60/60 Sign	Speckle Tracking: Decreased Free Wall Strain	
			

Illustrations (cont'd)

Linda Qiu MD	ACUTE PULMONARY EMBOLISM VS CHRONIC PULMONARY HYPERTENSION			Stephen Alerhand MD
RIGHT HEART THROMBUS	RIGHT VENTRICULAR FREE WALL THICKNESS	TRICUSPID REGURGITATION PRESSURE GRADIENT	PULMONARY ARTERY ACCELERATION TIME	
Acute: 	Acute:  Chronic: 	Acute:  Chronic:  $4 \times TRV_{max}^2$ $\leq 46 \text{ mmHg}$ ($\leq 3.4 \text{ m/sec}$)	Acute:  Chronic:  $\geq 60 - 80 \text{ msec}$	Pulmonary Artery Acceleration Time
60 / 60 SIGN	PULMONARY ARTERY EARLY-SYSTOLIC NOTCHING	McCONNELL'S SIGN	RIGHT ATRIAL ENLARGEMENT	
Acute:  +  TRPG $\leq 60 \text{ mmHg}$ PAAT $\leq 60 \text{ msec}$	Proximally Located, Higher-Risk PE:  ECG: 	Acute:  RA = LA	Acute:  Chronic:  RA > LA	



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