

**ECHO**
AUSTRALIA

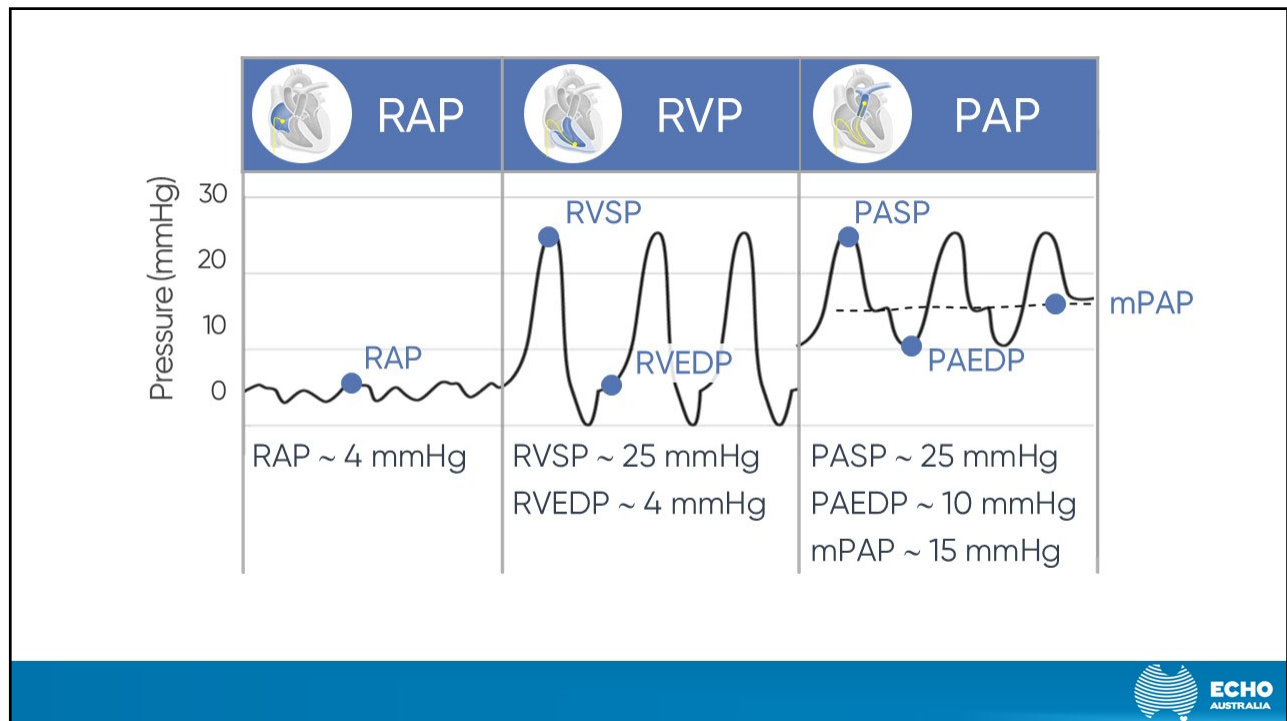
Transthoracic Evaluation of Right-sided Heart Pressures

Bonita Anderson
(No disclosures)

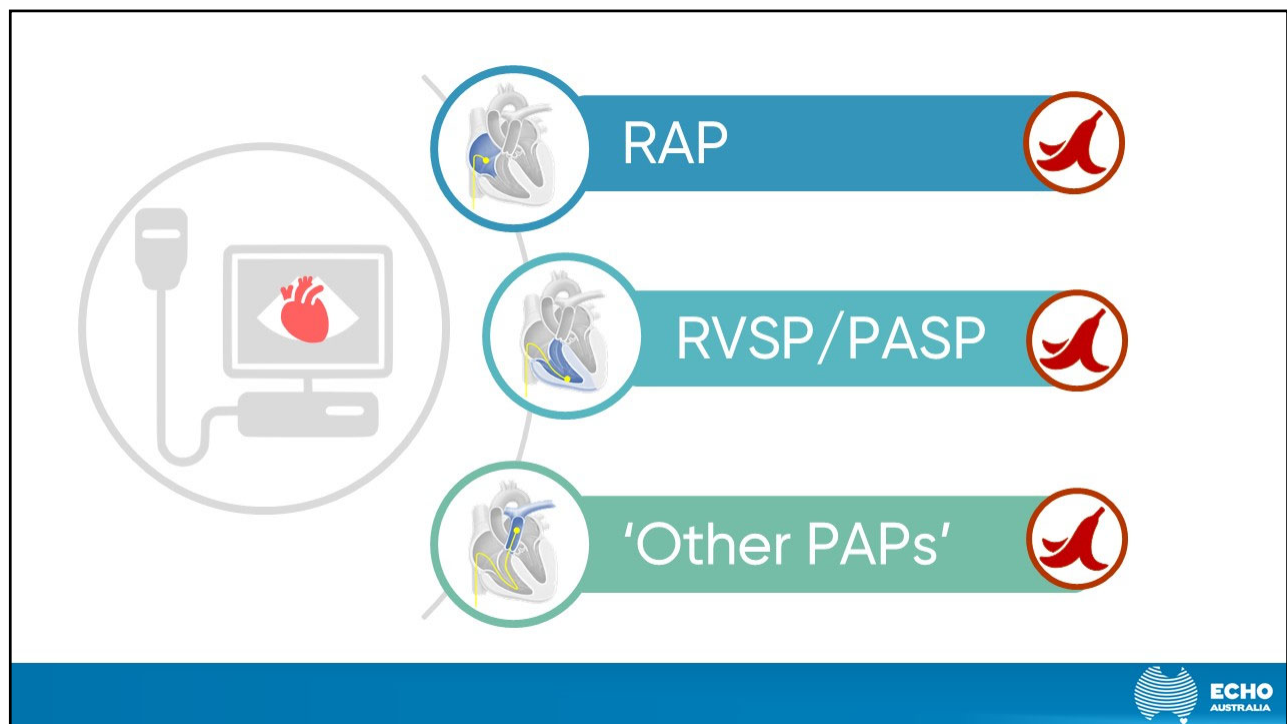


17 – 19 March 2025
Marvel Stadium, Melbourne

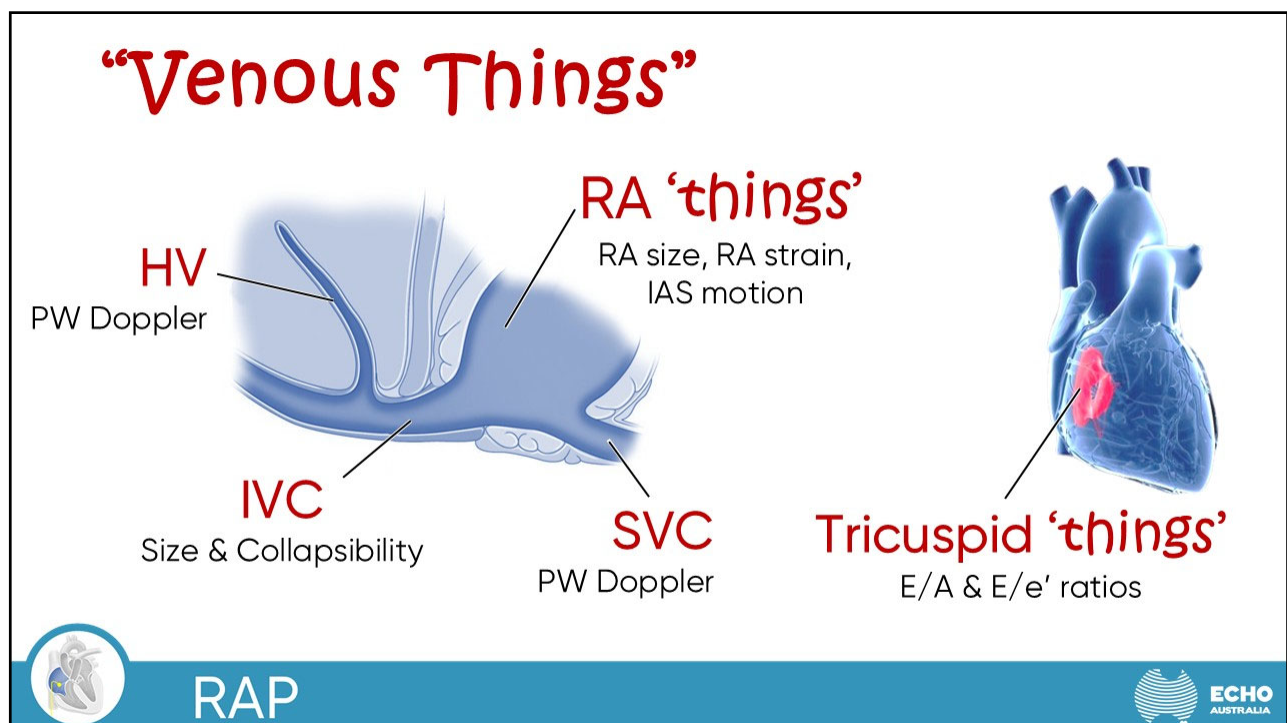
1



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3



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IVC

Size & Collapsibility



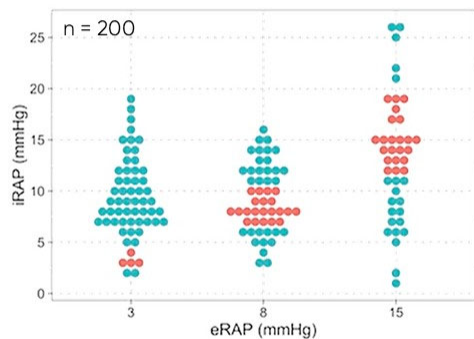
Normal RAP (av. 3 mmHg)
≤ 2.1 cm, > 50% collapse
Intermediate RAP (av. 8 mmHg)
≤ 2.1 cm, < 50% collapse
>2.1 cm, ≥ 50% collapse
High RAP (av. 15 mmHg)
> 2.1 cm, < 50% collapse
Very High RAP (20 mmHg)
> 2.5 cm, < 20% collapse, + SEC

Mukherjee, M, et al. J Am Soc Echocardiogr 2025;38:141-86

RAP

5

HOWEVER,



eRAP based on IVC
may **over- or under-**
estimate iRAP

Echo RAP(eRAP) compared with RHC RAP (iRAP)
Orange dots = accurate estimates; Relative accuracy 31%
 Magnino C, et al. Am J Cardiol 2017;120:1667–1673

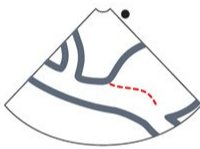
RAP

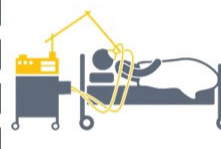
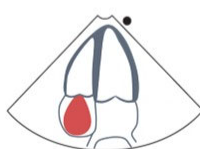
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HOWEVER,

Dilated IVC in absence of high RAP may be seen ...







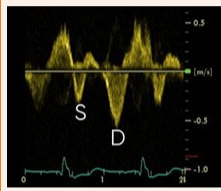
RAP



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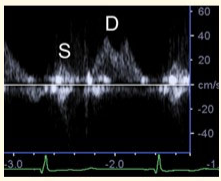
Other Supporting Evidence of ↑ RAP

HV PWD



$S/D < 1$
 $SSF < 55\%$
 $[SSF = S/(S+D)]$

SVC PWD

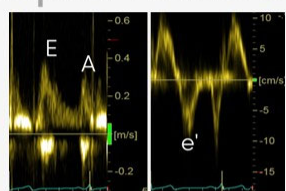


$S/D < 1.9$



Tricuspid Ratios

$E/A \geq 1.1$
 $E/e' > 6$



RA Reservoir Strain

< -15%



RA

Dilated + IAS bows R-L

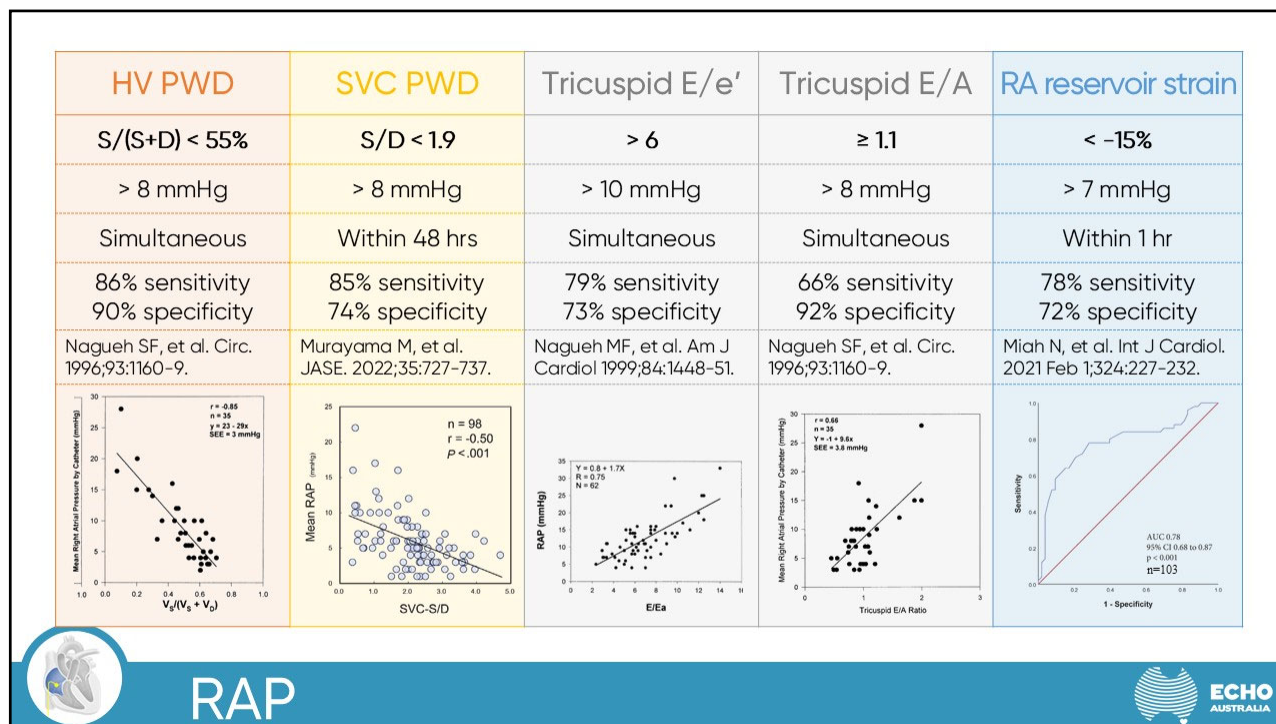




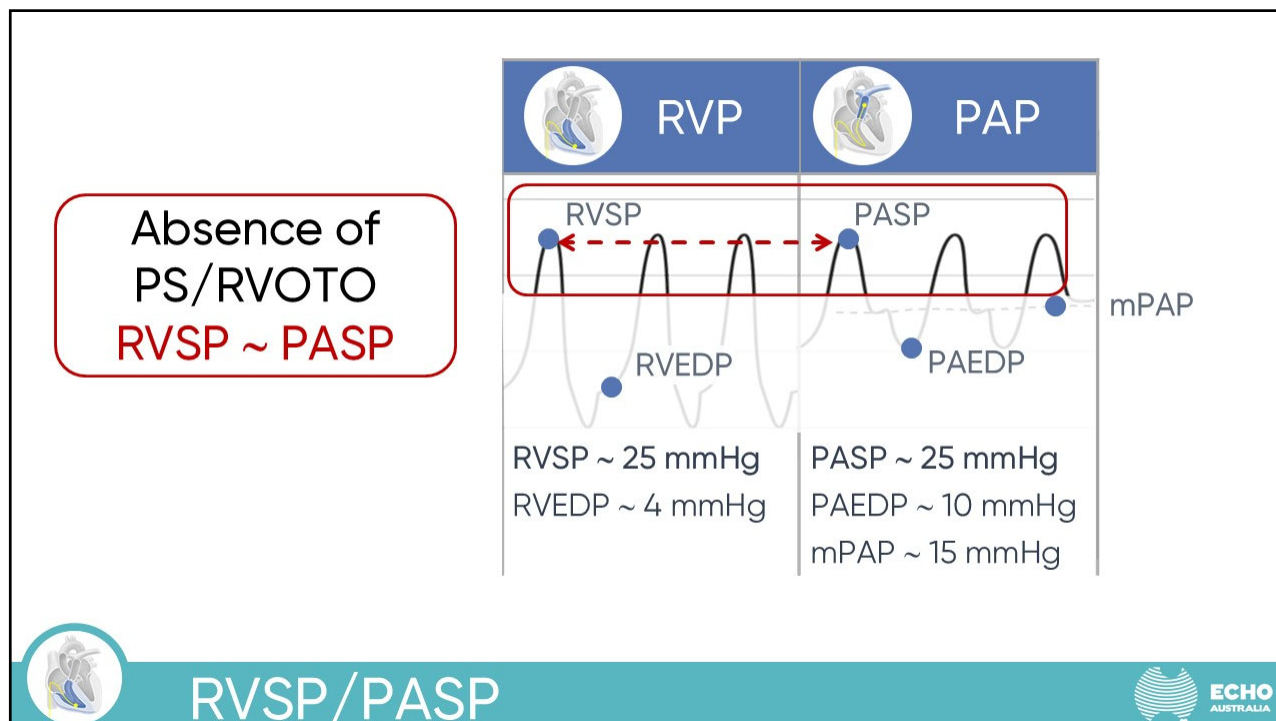
RAP



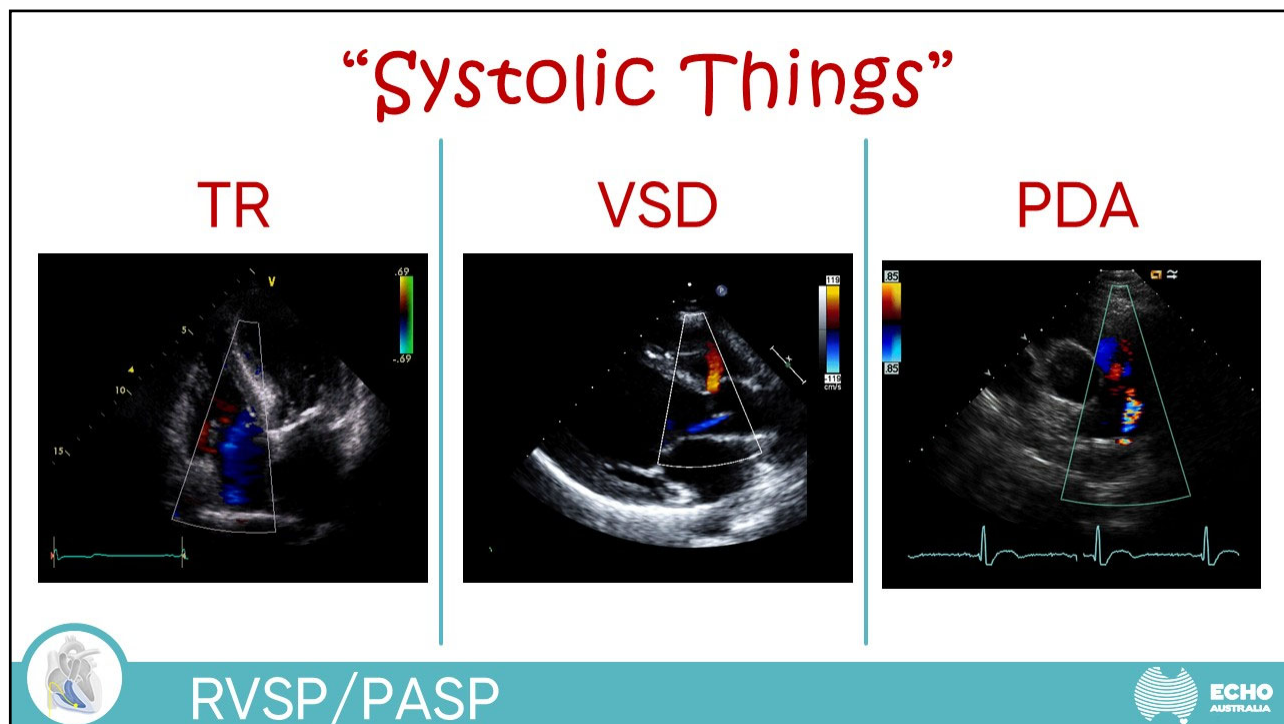
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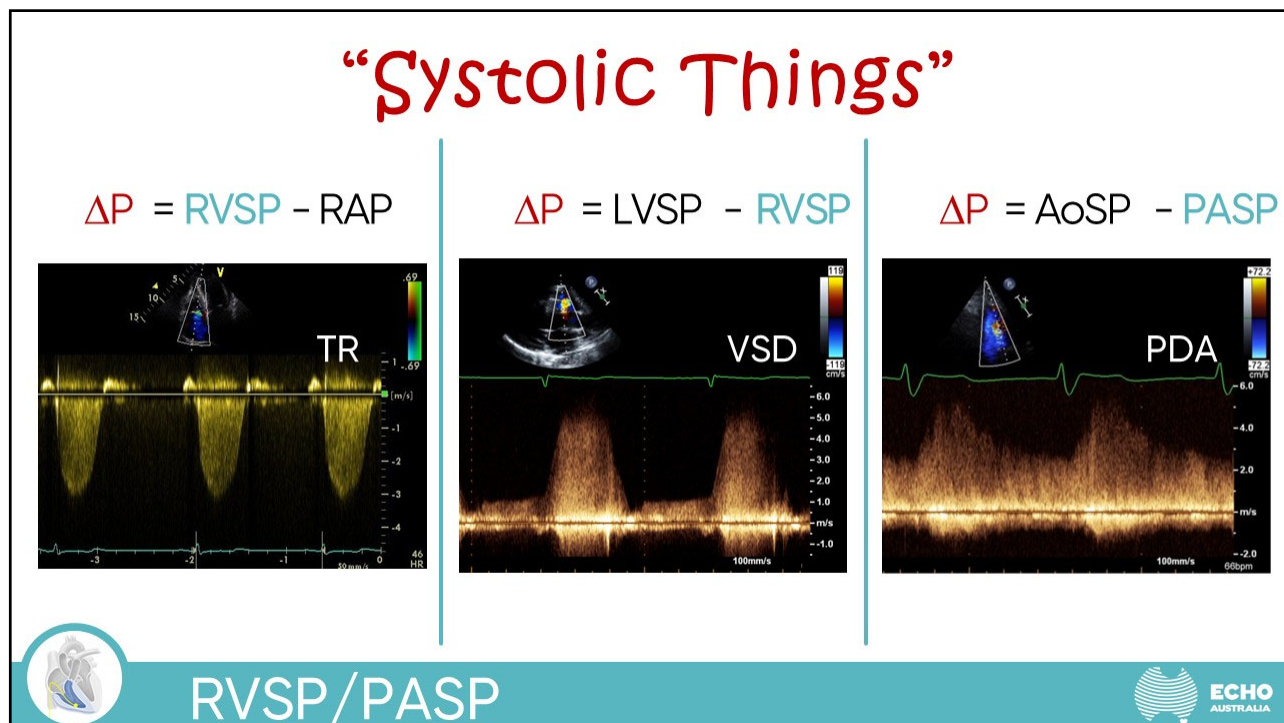
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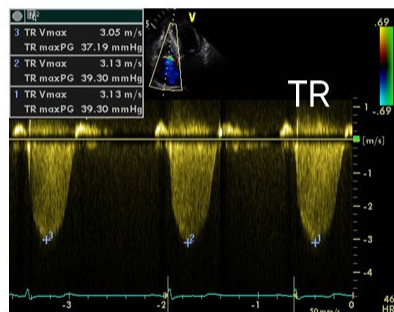
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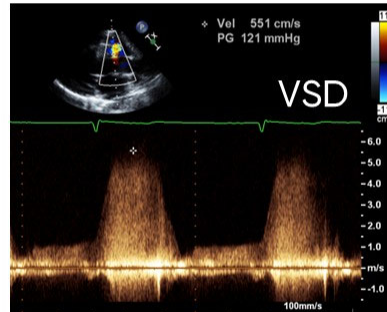
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“Systolic Things”

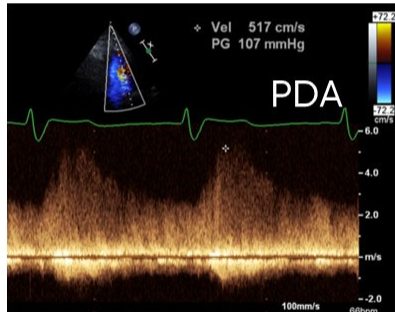
$$RVSP = 4V_{TR}^2 + RAP$$



$$RVSP = SBP - 4V_{VSD}^2$$



$$PASP = SBP - 4V_{PDA}^2$$



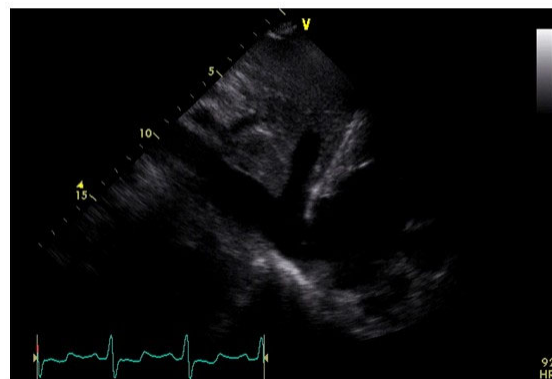
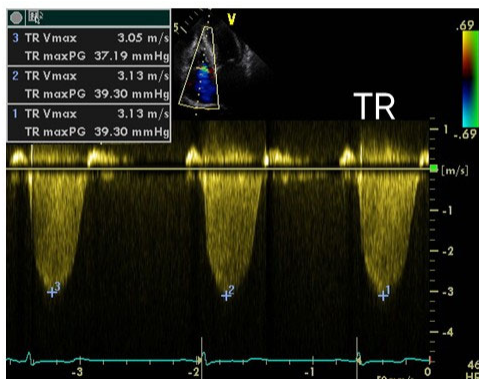
RVSP/PASP



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“Systolic Things”

$$RVSP = 4V_{TR}^2 + RAP$$



RVSP/PASP



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Pitfalls

$$RVSP = 4V_{TR}^2 + RAP$$

Done ✓



RVSP/PASP



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Pitfalls

$$RVSP = 4V_{TR}^2 + RAP$$

Measuring incomplete signals

Measuring the 'beard'

Non-parallel alignment

"Massive" TR

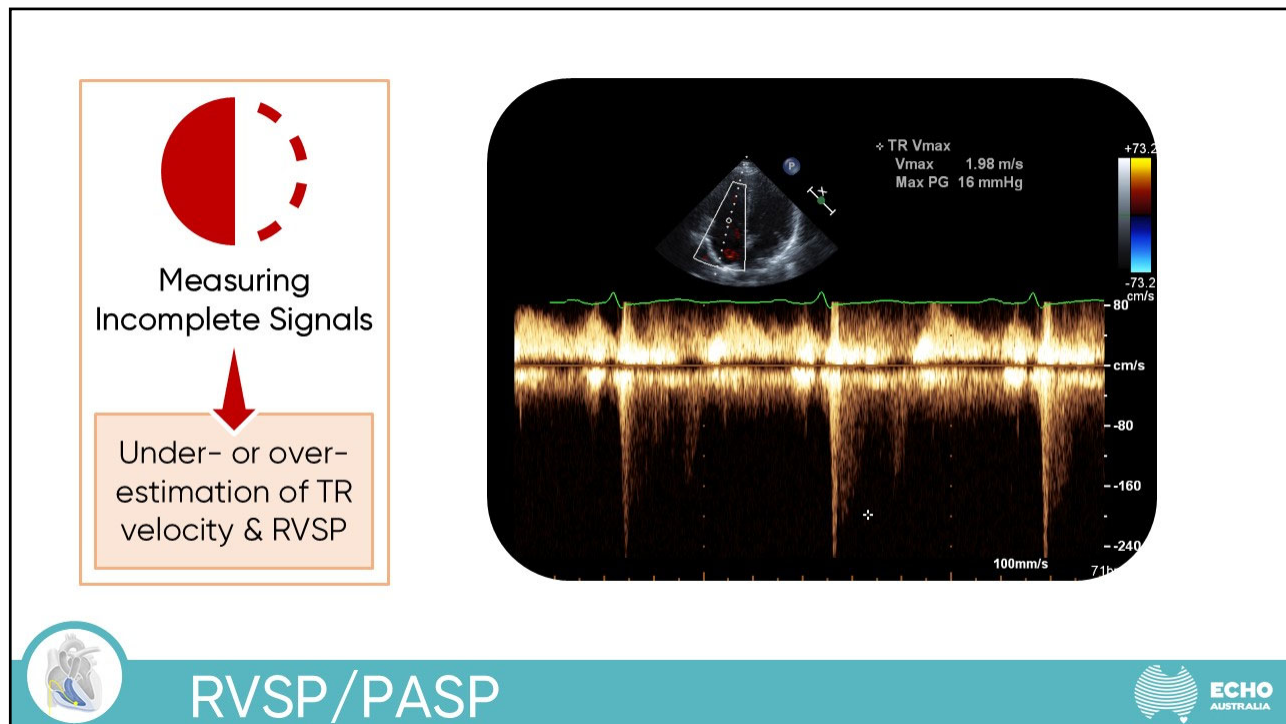


RVSP/PASP

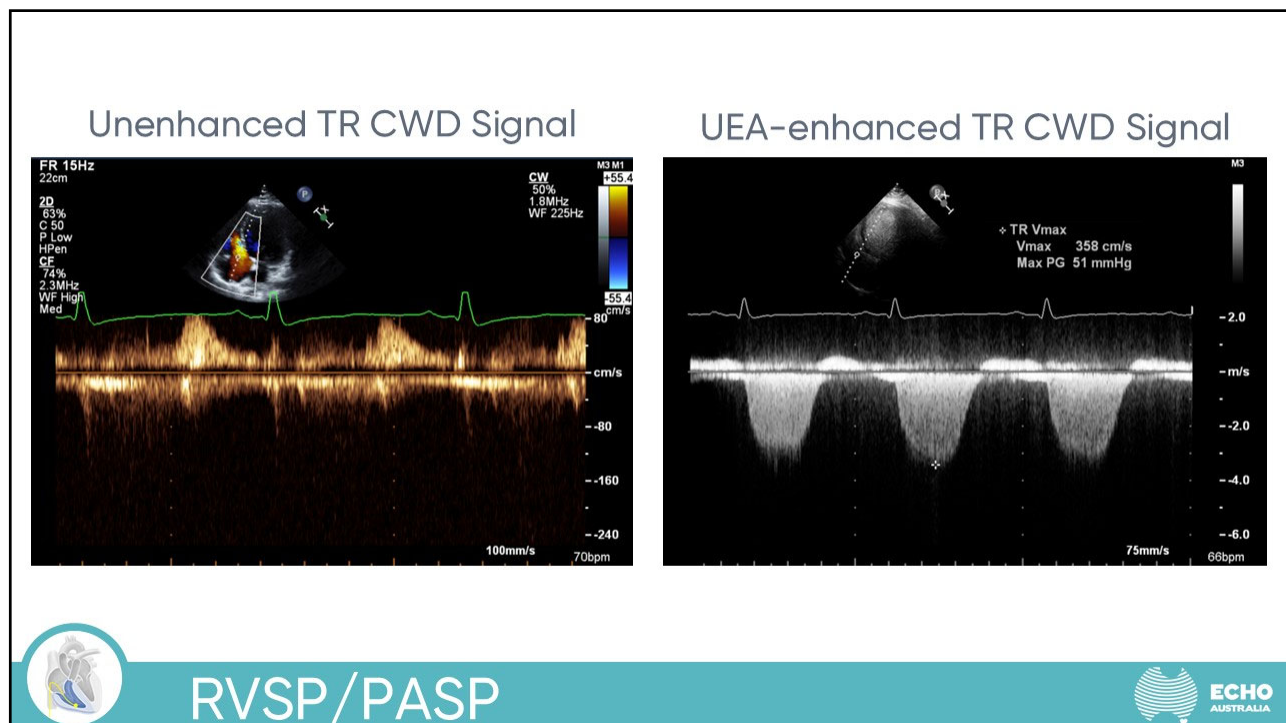


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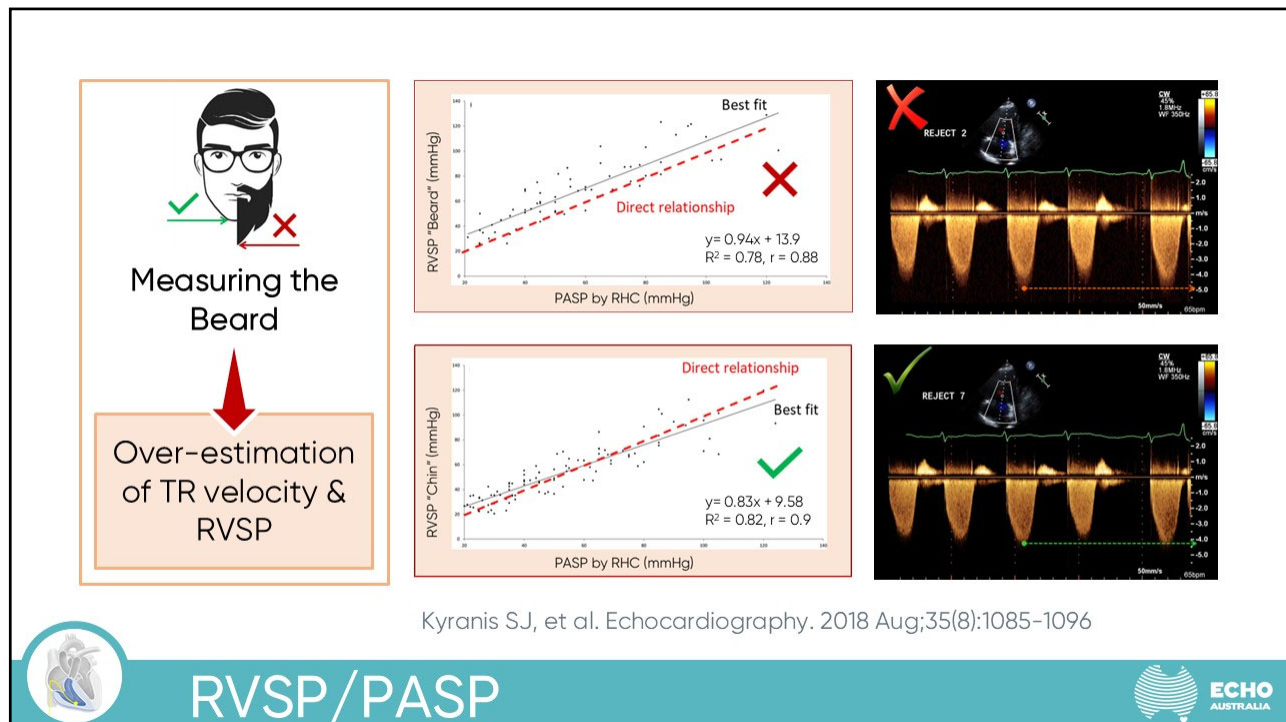
Bonita Anderson



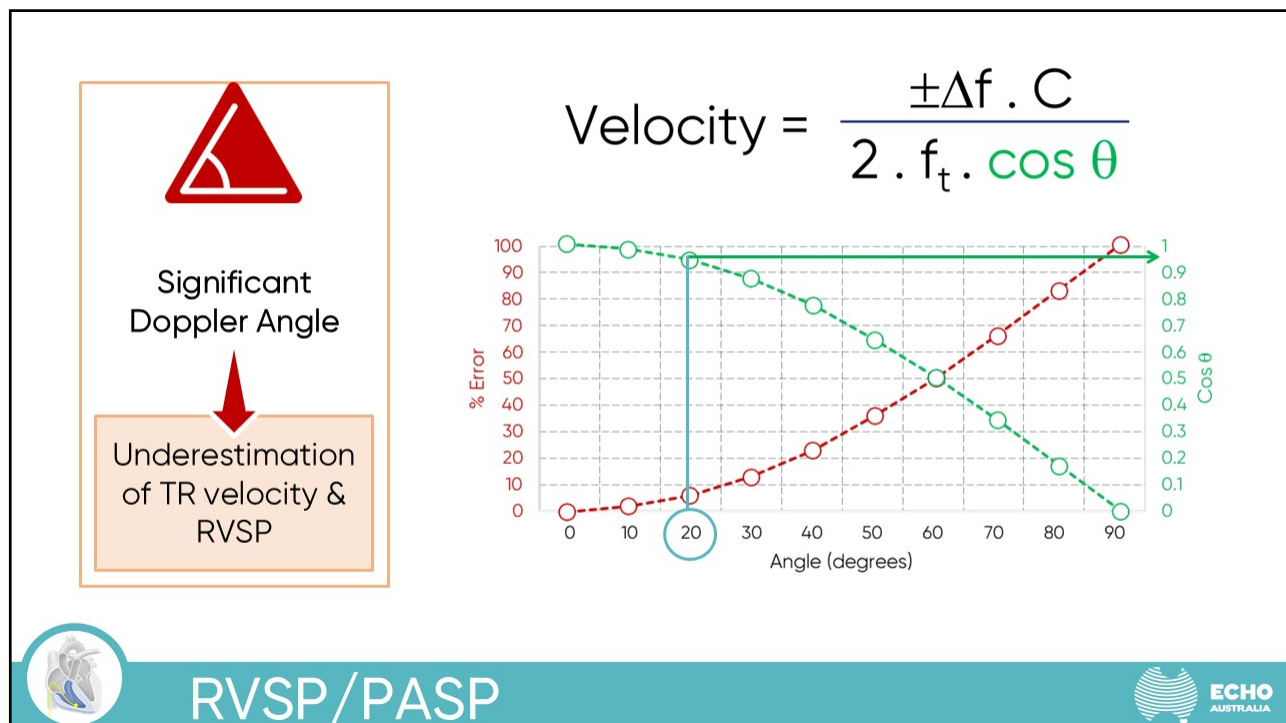
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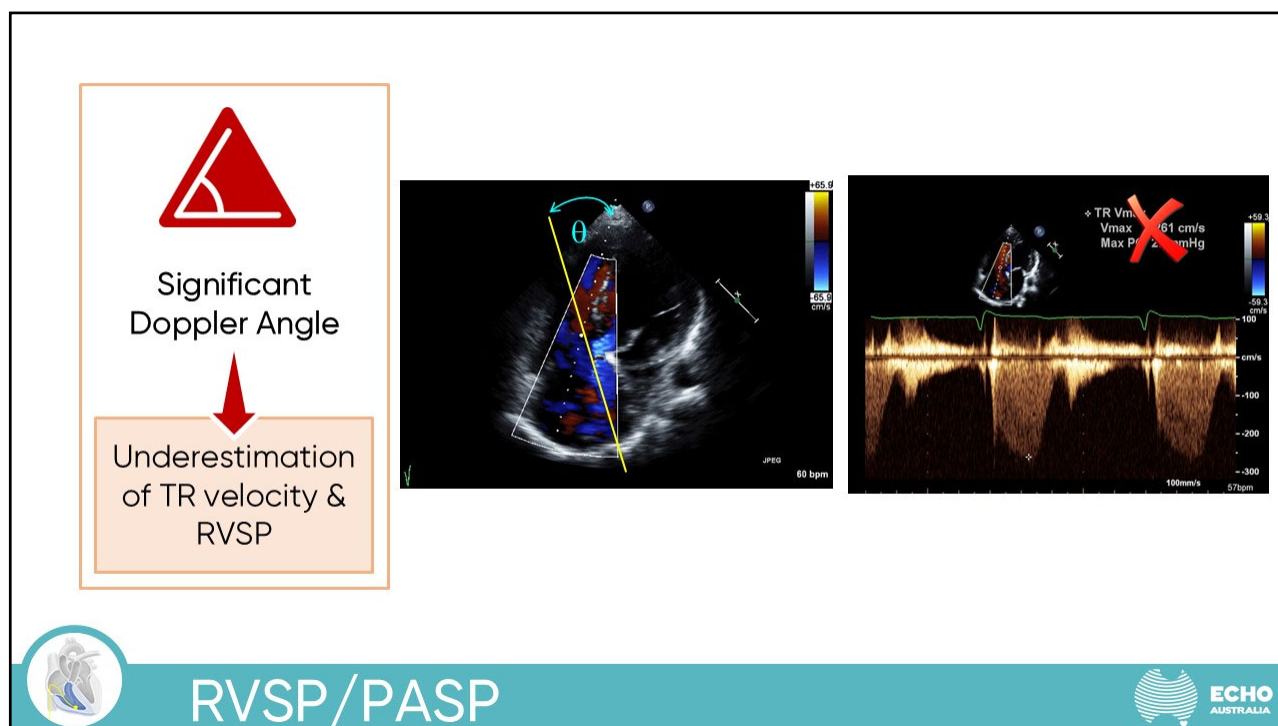
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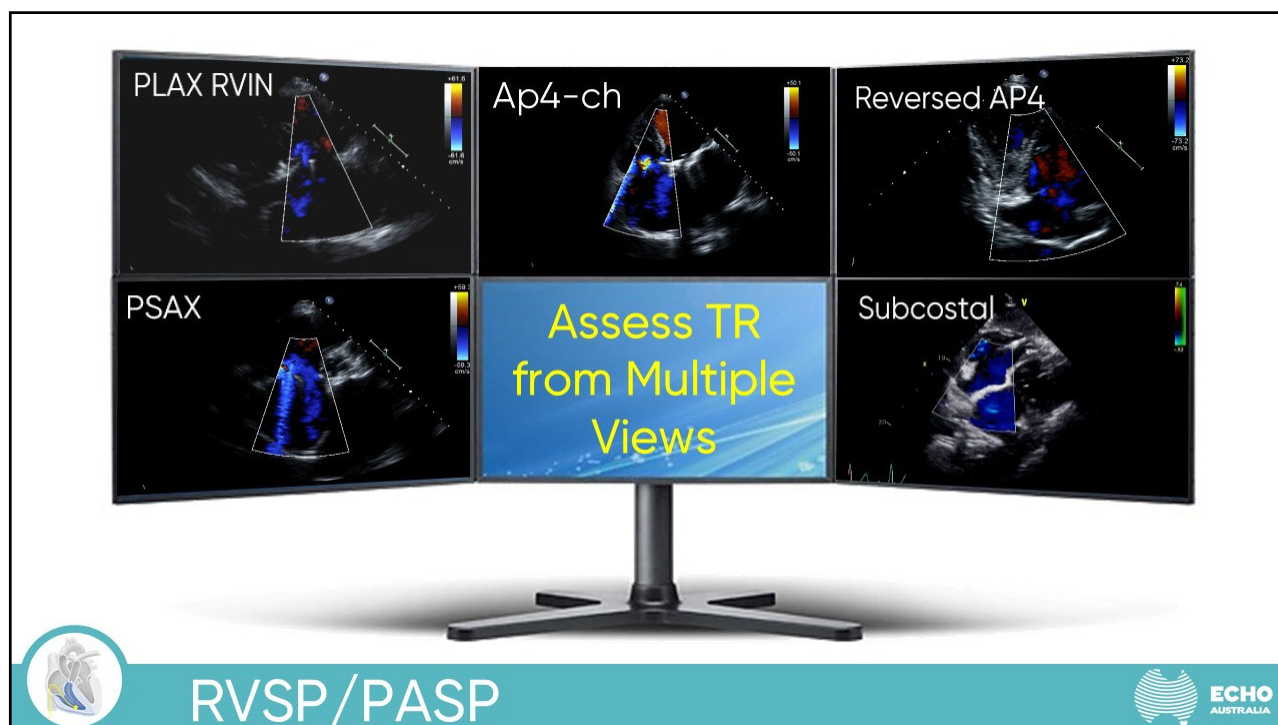
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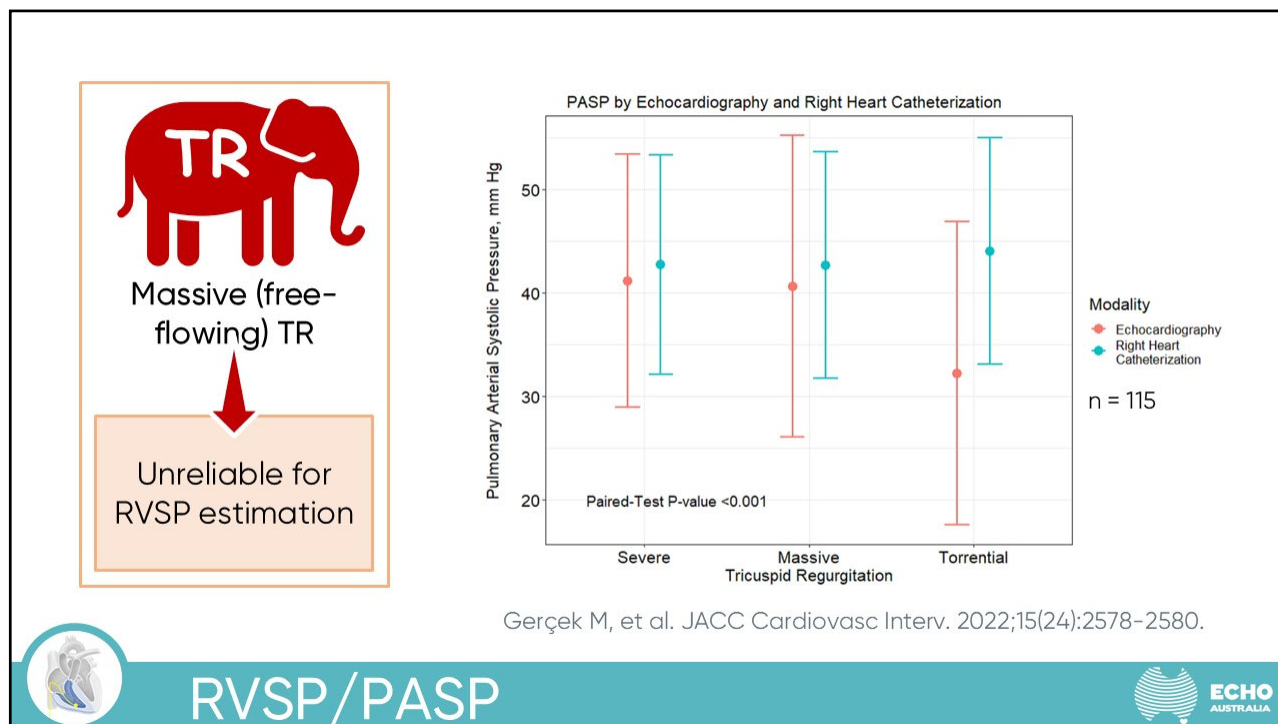
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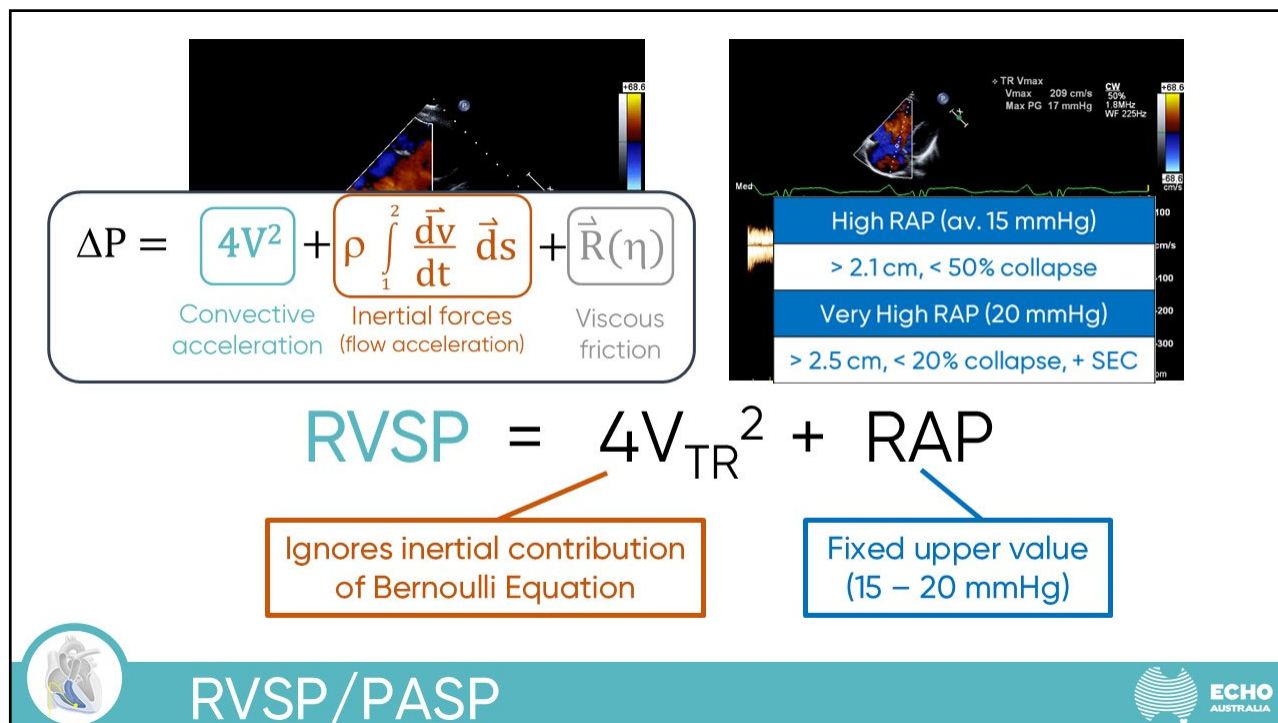
21



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Pitfalls

$$RVSP = 4V_{TR}^2 + RAP$$

Assumption
RVSP ~ PASP

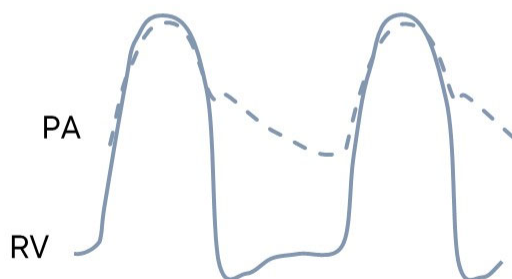


RVSP/PASP



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No PS or RVOTO



RVSP ~ PASP

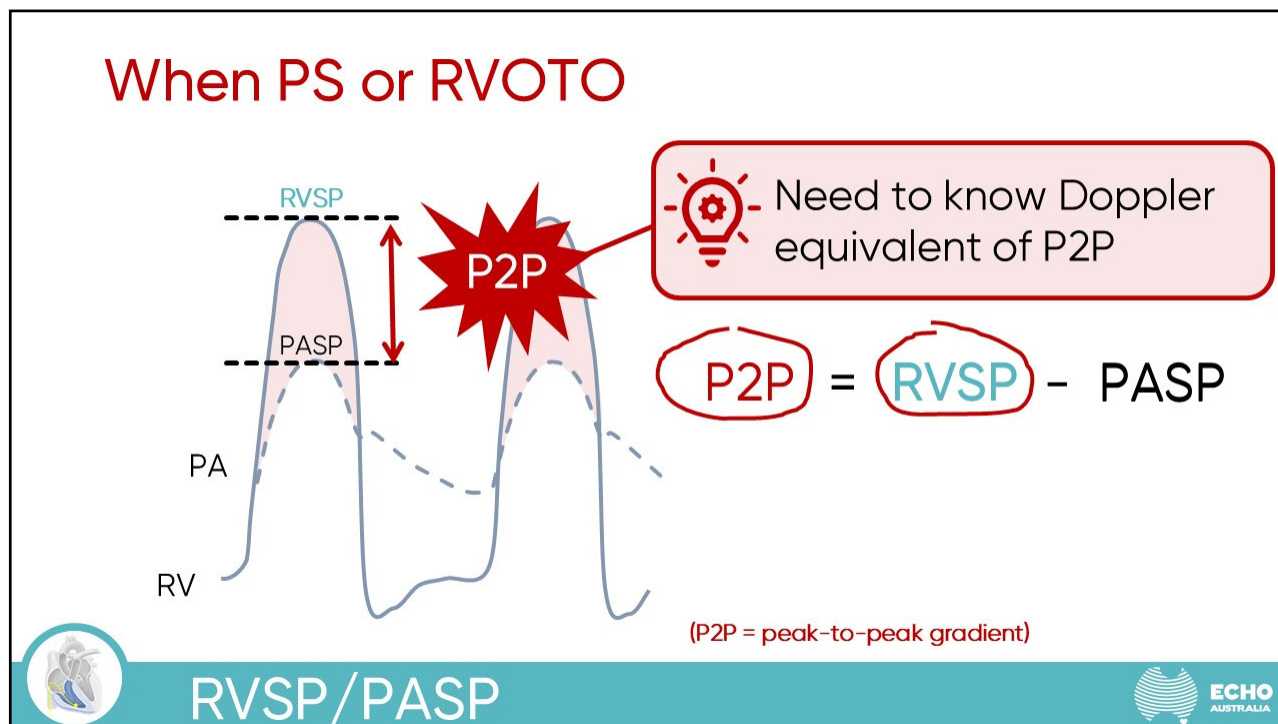


RVSP/PASP

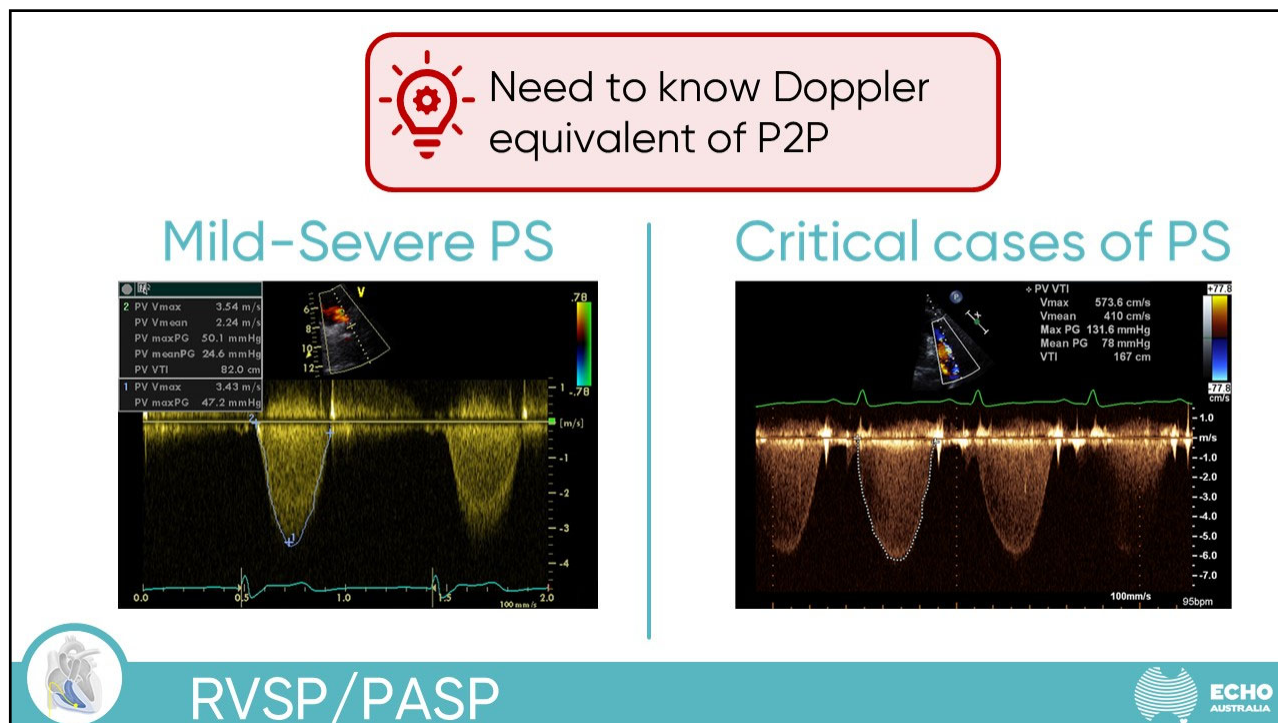


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Mild-Severe PS

P2P ~ mean Doppler PG

Silvilairat S, et al. J Am Soc Echocardiogr 2005;18:1137-1142

$$\text{PASP} = \text{RVSP} - \text{P2P}$$

$$= \text{RVSP} - \text{mean } \Delta P_{\text{PS}}$$

Critical cases of PS

P2P ≈ max. ΔP_{PS}

Currie et al. J Am Coll Cardiol. 1986 Apr;7(4):800-6.

$$\text{PASP} = \text{RVSP} - \text{P2P}$$

$$= \text{RVSP} - \text{max. } \Delta P_{\text{PS}}$$

RVSP/PASP

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“PR & RVOT Things”

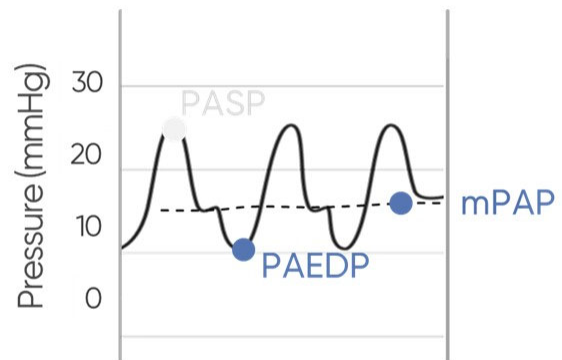
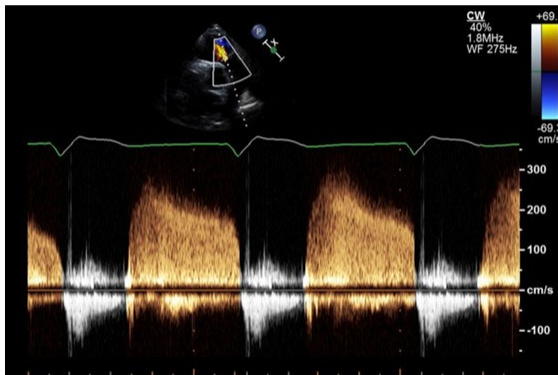
PR

RVOT PWD

‘Other PAPs’

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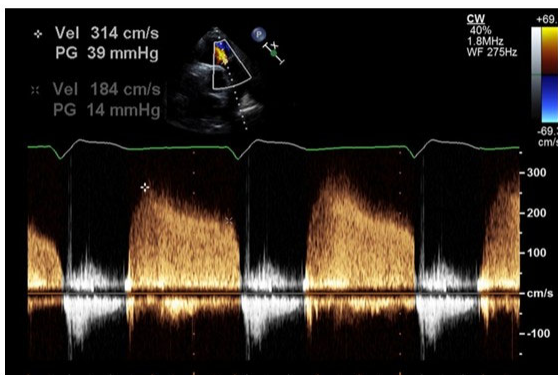
“PR & RVOT Things”



‘Other PAPs’

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“PR & RVOT Things”



$$\text{PAEDP} = 4V_{\text{PR-ED}}^2 + \text{RAP}$$

$$\text{mPAP} = 4V_{\text{PR-early}}^2 + \text{RAP}$$

* In absence of TS, RVEDP ~ RAP



‘Other PAPs’

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Pitfalls

$$\text{PAEDP} = 4V_{\text{PR-ED}}^2 + \text{RAP}$$

$$\text{mPAP} = 4V_{\text{PR-early}}^2 + \text{RAP}$$



'Other PAPs'

33



Pitfalls



$$\text{PAEDP} = 4V_{\text{PR-ED}}^2 + \text{RAP}$$

$$\text{mPAP} = 4V_{\text{PR-early}}^2 + \text{RAP}$$

❌ Estimation from IVC



'Other PAPs'

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Pitfalls



$$\text{PAEDP} = 4V_{\text{PR-ED}}^2 + \text{RAP}$$

$$\text{mPAP} = 4V_{\text{PR-early}}^2 + \text{RAP}$$

- ❌ Incomplete signals
- ❌ Measuring the beard
- ❌ Non-parallel alignment



'Other PAPs'

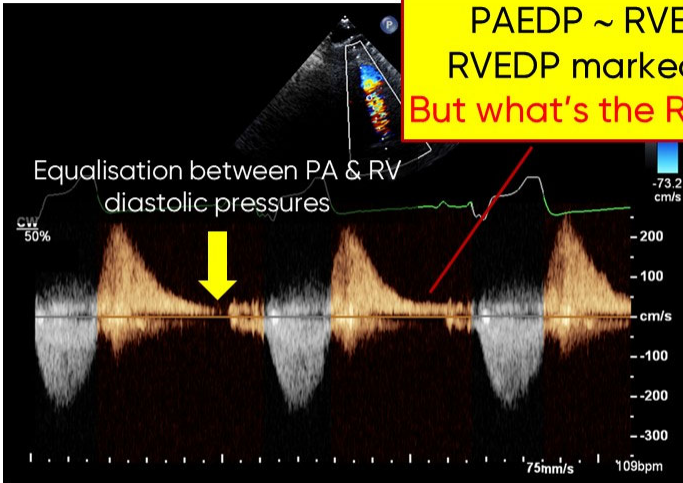
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Marked elevation
in RVEDP

↓

Unreliable for
estimation of
PAEDP

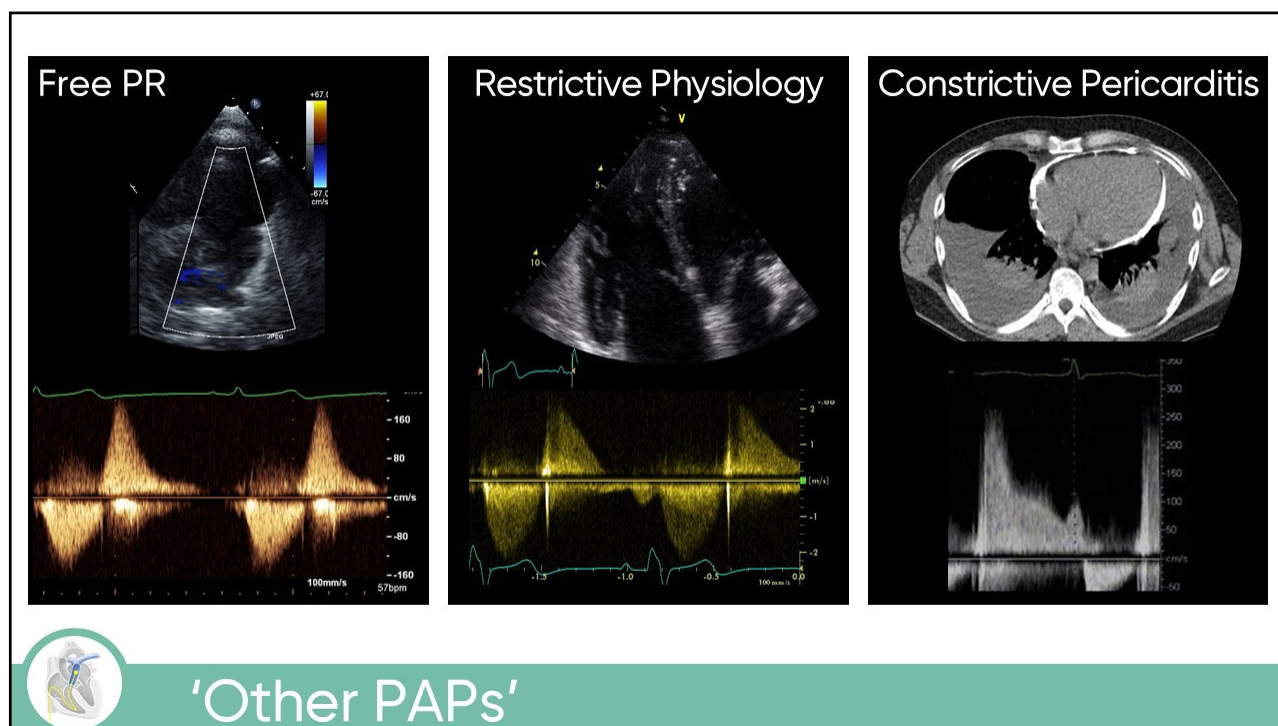


PAEDP ~ RVEDP
 RVEDP markedly ↑
 But what's the RVEDP?

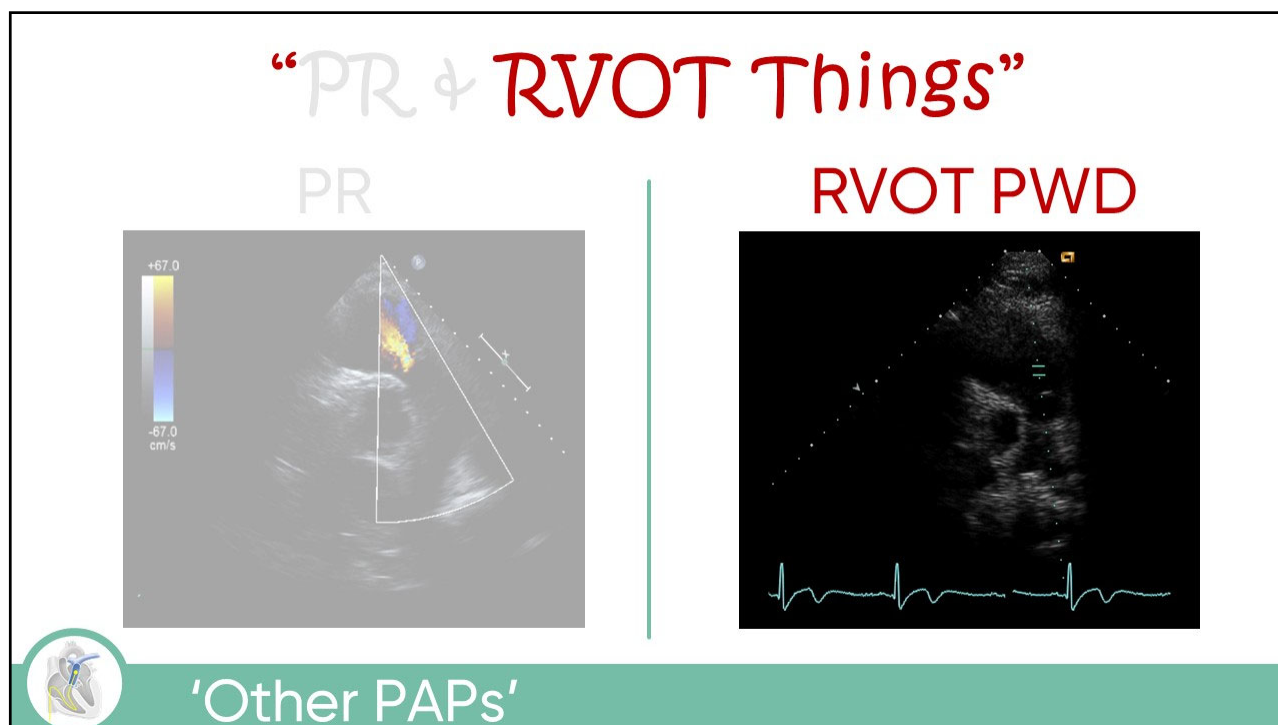


'Other PAPs'

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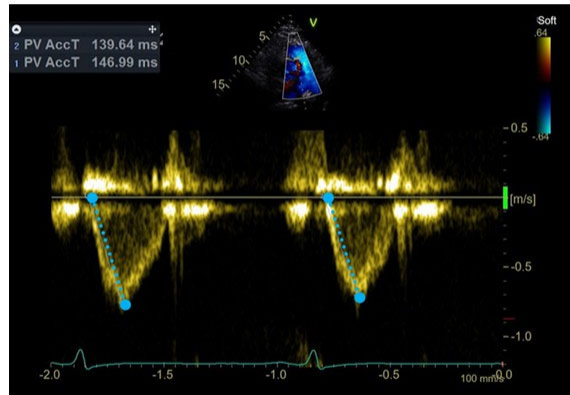
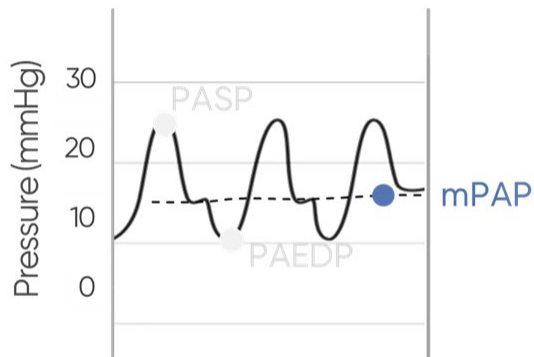


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“PR & RVOT Things”



‘Other PAPs’

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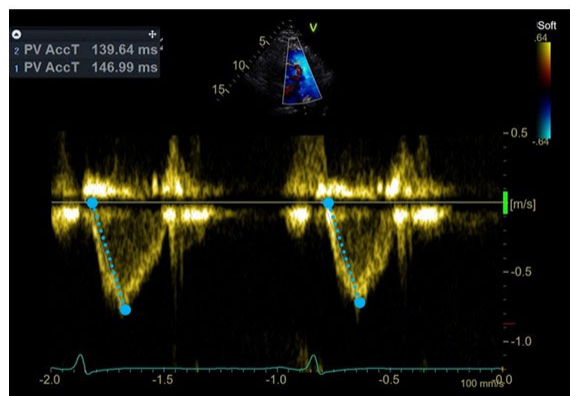
“PR & RVOT Things”

$$\text{mPAP} = 79 - (0.45 \times \text{AT})^{[1]}$$

$$\text{mPAP} = 90 - (0.62 \times \text{AT})^{[2]}$$

[1] Mahan G, et al. Circulation 1983;68:367.

[2] Dabestani A, et al. Am J Cardiol. 1987;59:662-668
When AT < 120 ms



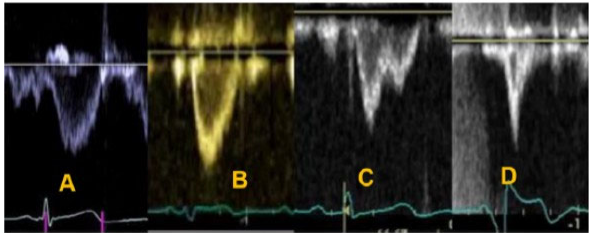
‘Other PAPs’

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GUIDELINES AND STANDARDS

Guidelines for the Echocardiographic Assessment of the Right Heart in Adults and Special Considerations in Pulmonary Hypertension: Recommendations from the American Society of Echocardiography

Monica Mukherjee, MD, MPH, FASE, Chair, Lawrence G. Rudski, MDCM, FASE, Co-Chair, Karima Addetia, MD, FASE, Jonathan Afila, MD, MSc, Michele D'Alto, MD, PhD, Benjamin H. Freed, MD, FASE, Lynsly B. Friend, ACS, RCS, FASE, Luna Gargani, MD, PhD, Julia Grapsa, MD, PhD, FASE, Paul M. Hassoun, MD, Lanqi Hua, RDCS, FASE, Jiwon Kim, MD, FASE, Valentina Mercurio, MD, PhD, Rajan Sagar, MD, and Anton Vonk-Noordegraaf, MD, PhD, *Baltimore, Maryland; Montreal, Quebec, Canada; Chicago, Illinois; Naples and Pisa, Italy; Lebanon, New Hampshire; London, United Kingdom; Boston, Massachusetts; New York, New York; Los Angeles, California; and Amsterdam, the Netherlands*



Normal
> 105 ms
Mild Abnormality Grade
≥ 80 to ≤ 105 ms
Moderate Abnormality Grade
≥ 60 to < 80 ms
Severe Abnormality Grade
≤ 60 ms

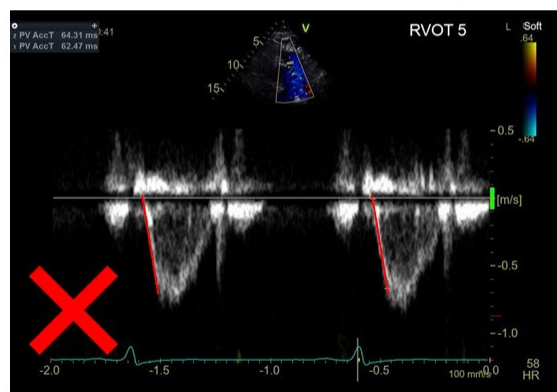
Mukherjee, M, et al. J Am Soc Echocardiogr 2025;38:141-86

'Other PAPs'

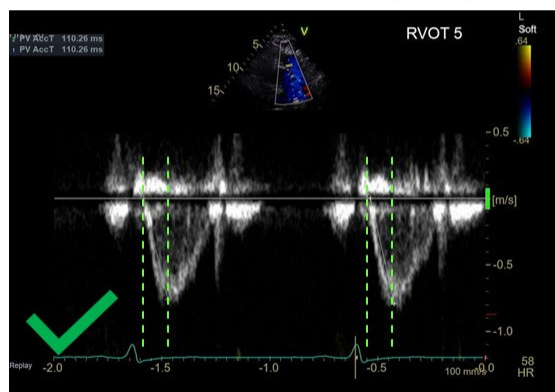
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Primary Pitfall

Measuring the Slope

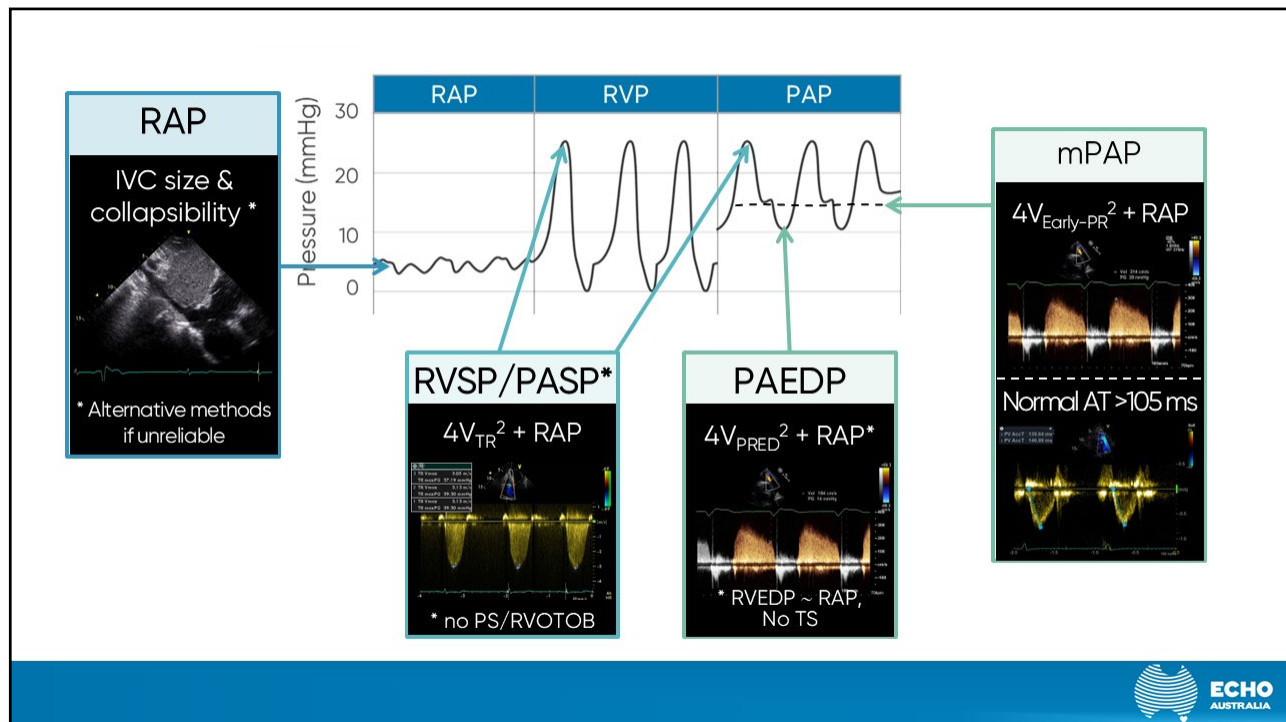


Instead of the Time



'Other PAPs'

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EVERYTHING HAS ITS LIMITATIONS

Dalek and stairs Cartoon
<https://magazine.punch.co.uk/image/I0000ZvIeumhOmDo>

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Bonita Anderson