

# 3D Quantitative Doppler

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## Disclosures

- None relevant

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## Outline

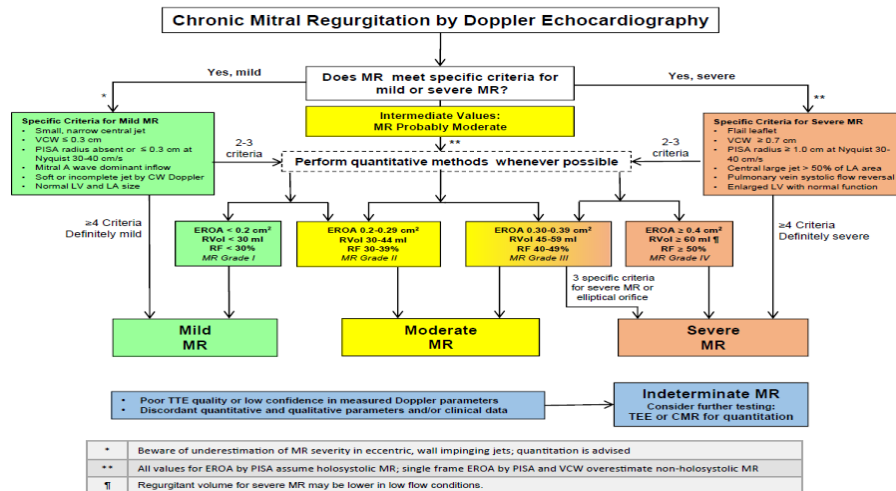
- Current quantitative methods / limitations
- Quantitative Doppler for Stroke Volume
- Quantitative Doppler for PISA

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## Current Methods

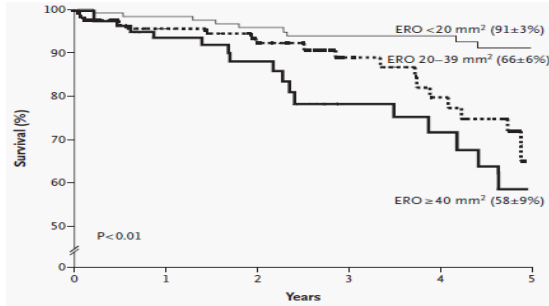


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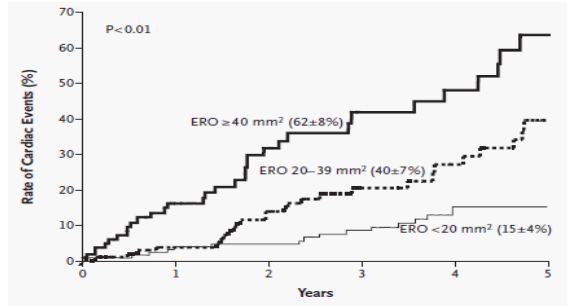


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# Current Methods



**Figure 1.** Kaplan–Meier Estimates of the Mean ( $\pm$ SE) Rates of Overall Survival among Patients with Asymptomatic Mitral Regurgitation under Medical Management, According to the Effective Regurgitant Orifice (ERO).



**Figure 3.** Kaplan–Meier Estimates of the Mean ( $\pm$ SE) Rates of Cardiac Events among Patients with Asymptomatic Mitral Regurgitation under Medical Management, According to the Effective Regurgitant Orifice (ERO).

Enriquez-Sarano M et al NEJM 2005;352: 875-83

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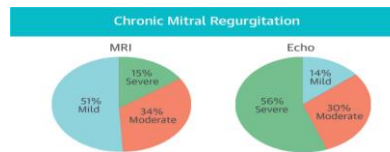
# Individual Patient Accuracy

**TABLE 3 Comparison of MR Severity: MRI Versus Echo**

	MRI			Total
	Mild	Moderate	Severe	
Echo				
Mild	14	0	0	14
Moderate	19	10	2	31
Severe	20	25	13	58
Total	53	35	15	103

Overall 54% agreement between the 2 modalities for severe versus non-severe MR

Uretsky et al, JACC, 2015; 65: 1078-88



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# Reproducibility

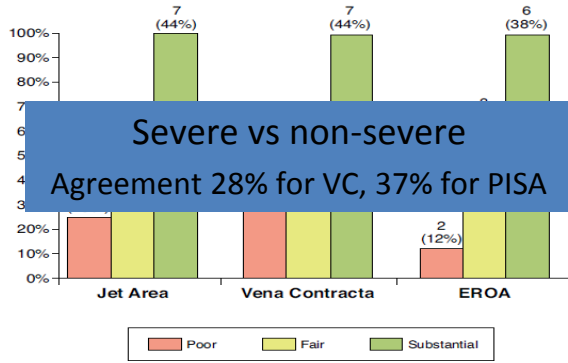


Figure 4. Distribution of Overall Raw Interobserver Agreement for Assessment of MR Severity

**TABLE 2 Interobserver Variability for MRI and Echo**

		MRI Reader 1			Echo Reader 1			
					Mild	Moderate	Severe	Total
Severe MR Agreement 79% by Echo 100% by MRI								
Echo reader 2	Mild	9	7	0	16			
	Moderate	5	14	15	34			
	Severe	0	9	34	43			
	Total	14	30	49	93			

Biner et al, JACC Cardiovasc Imaging. 2010; 3:235-43.

Uretsky et al, JACC, 2015; 65: 1078-88

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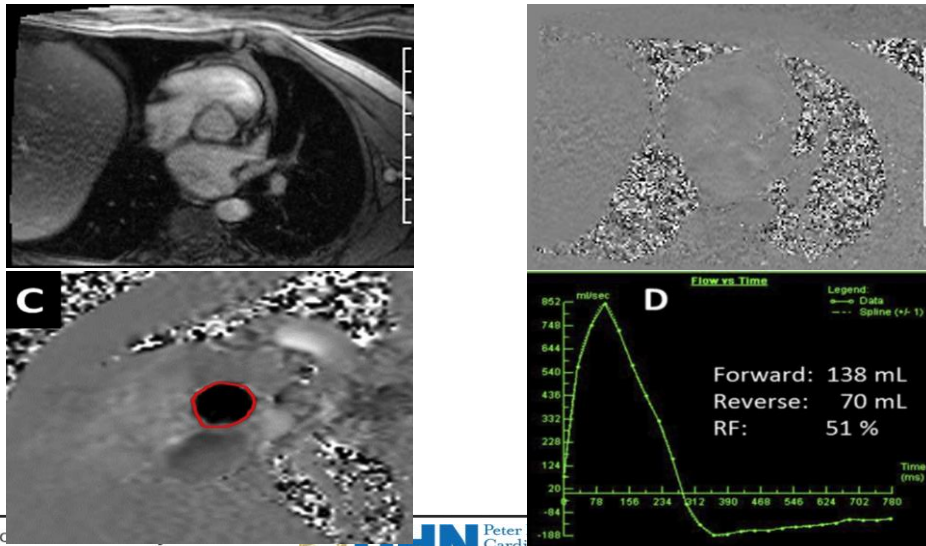
# Stroke Volume Method

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## Phase Contrast Imaging - CMR

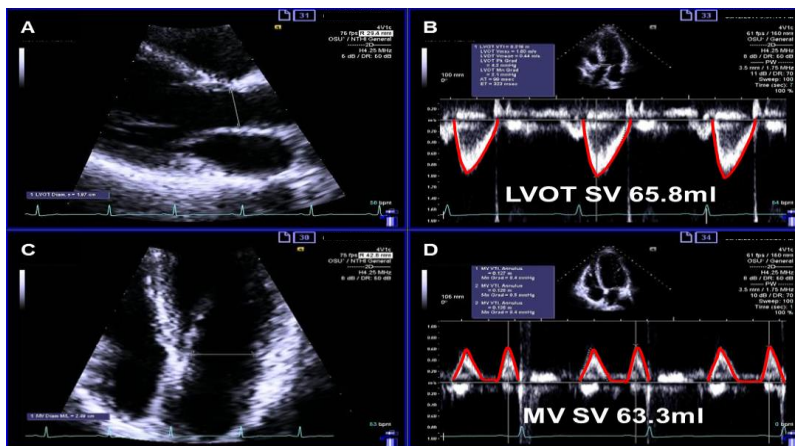


The Pro

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## Stroke Volume Technique



Thavendiranathan et al. J Am Soc Echocardiogr. 2012 Jan;25(1):56-65

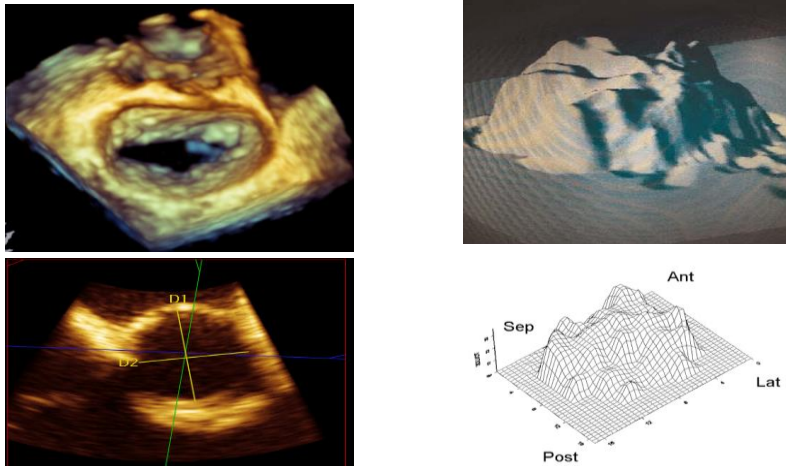
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## Stroke Volume Technique

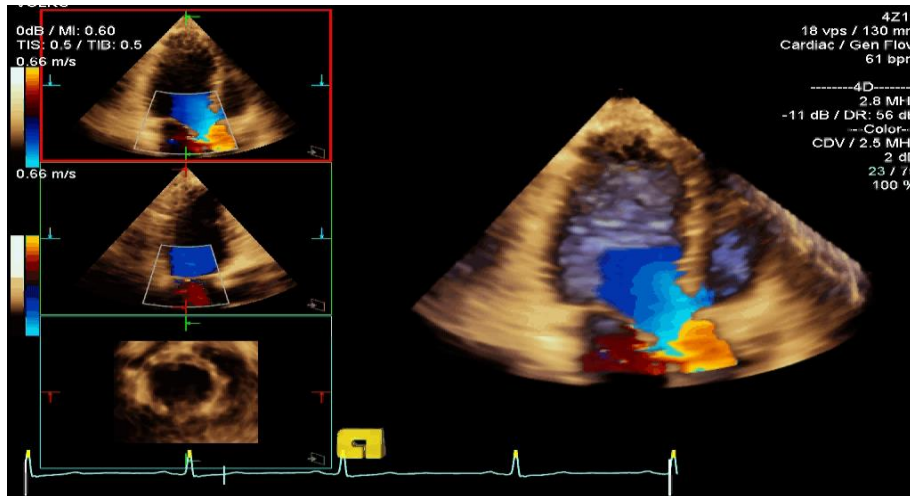


Matthews et al, Eur J Echo, 11: 432-37, 2010  
 Sujino et al, Ultrasound in Med and Biol, 27(1): 69-74, 2001

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## 3D Stroke Volume Technique

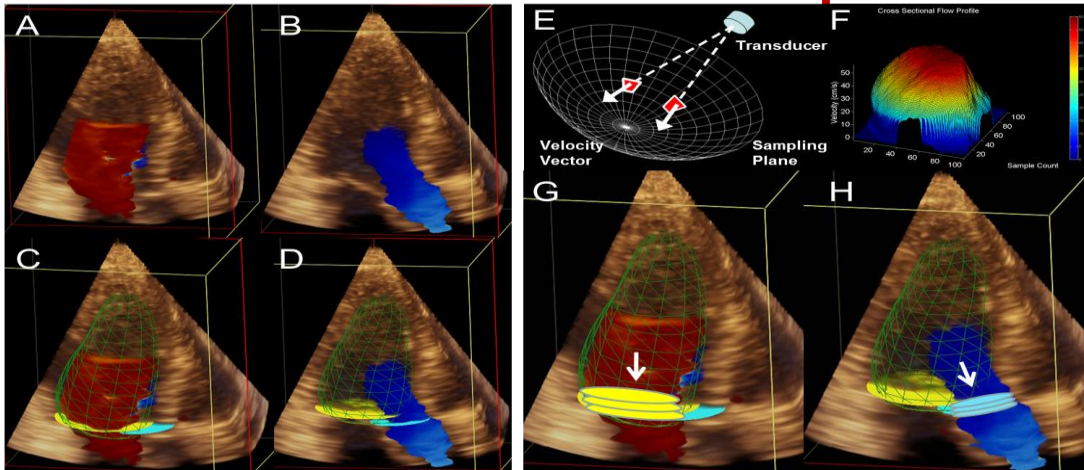


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## 3D Stroke Volume Technique

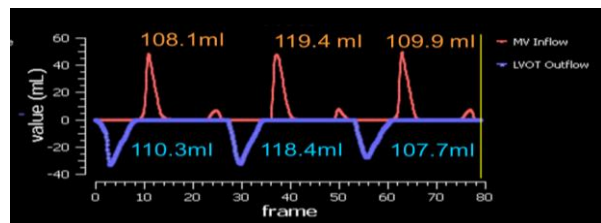
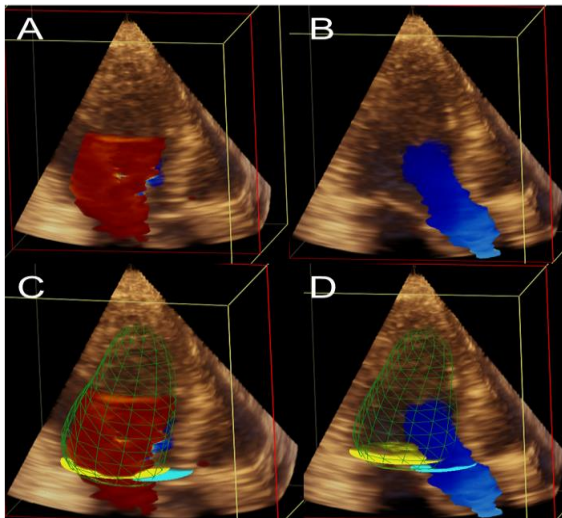


Thavendiranathan et al. J Am Soc Echocardiogr. 2012 Jan;25(1):56-65

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## 3D Stroke Volume Technique

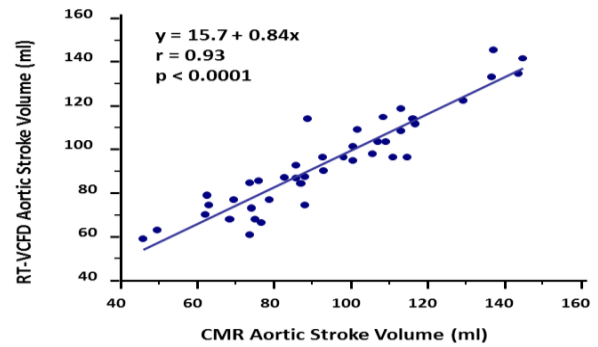
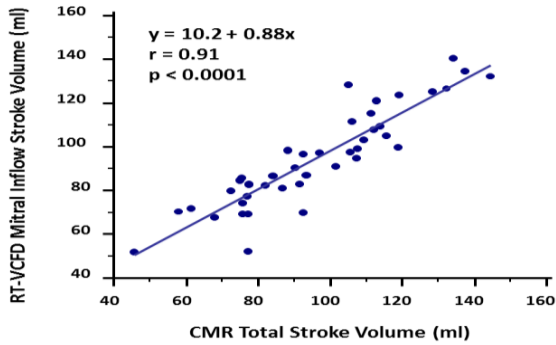


Thavendiranathan et al. JASE 2012 Jan;25(1):56-65

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## 3D Stroke Volume Technique



Validated with MRI LV stroke volume and aorta phase contrast volumes

Good Correlation – Minimal Bias on Bland Altman Plots

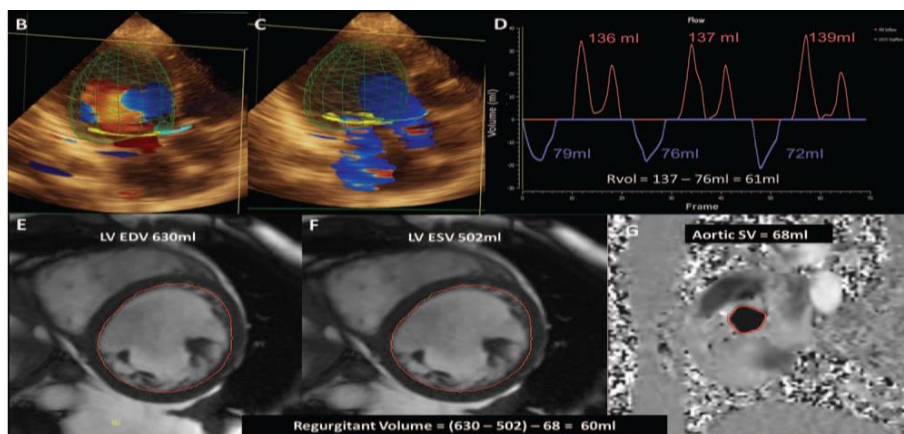
Thavendiranathan et al. JASE. 2012 Jan;25(1):56-65

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## 3D Stroke Volume - MR



Thavendiranathan et al. Circulation cardiovascular imaging 2013, 6(1): 125-33

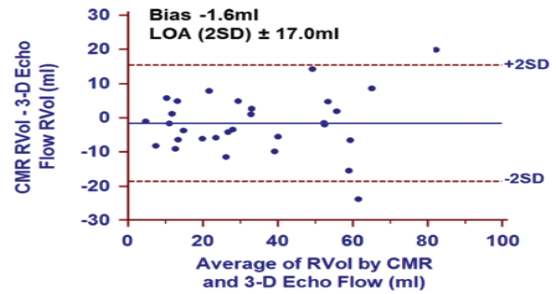
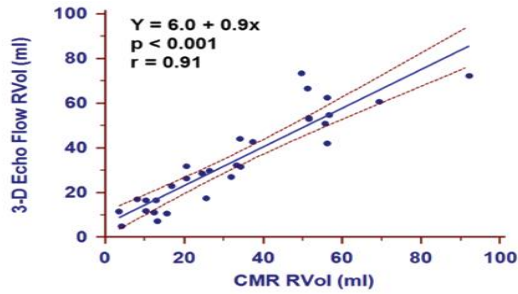
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## 3D Stroke Volume - MR



Thavendiranathan et al. Circulation cardiovascular imaging 2013, 6(1): 125-33  
 Song JM et al. J of Cardiovascular US 2012; 24(2): 24-30

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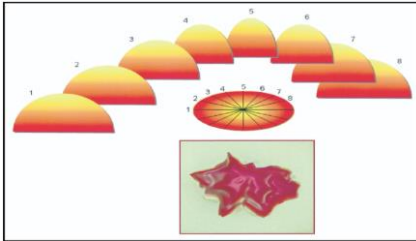
## PISA

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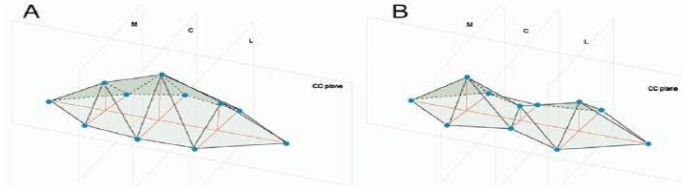


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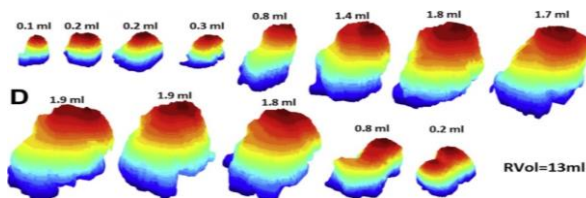
## 3D Color Doppler



Plicht et al, JASE, 2008;21:1337-46.



Yosefy al et al, JASE 2007;20:389-96.



Brugger N et al, AJC, 2015: 1130-1136

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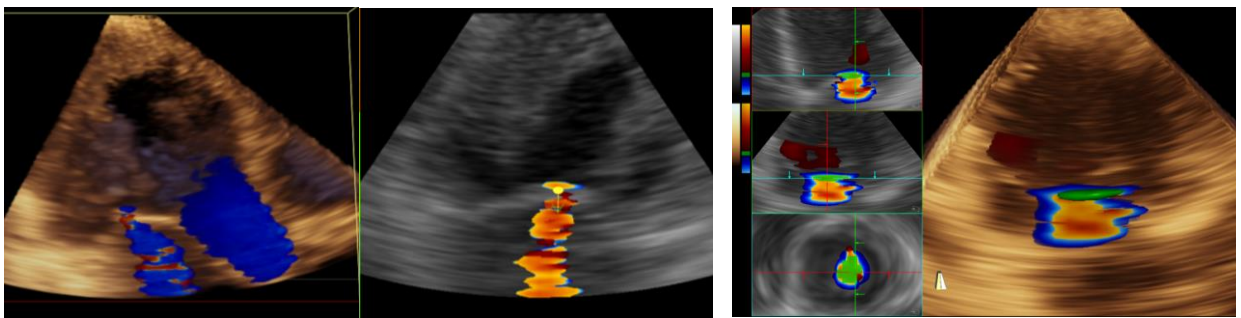


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Thavendiranathan et al. Circulation cardiovascular imaging 2013, 6(1): 125-33

De Augustin JA et al, J Am Soc Echocardiogr. 2012 Aug;25(8):815-23

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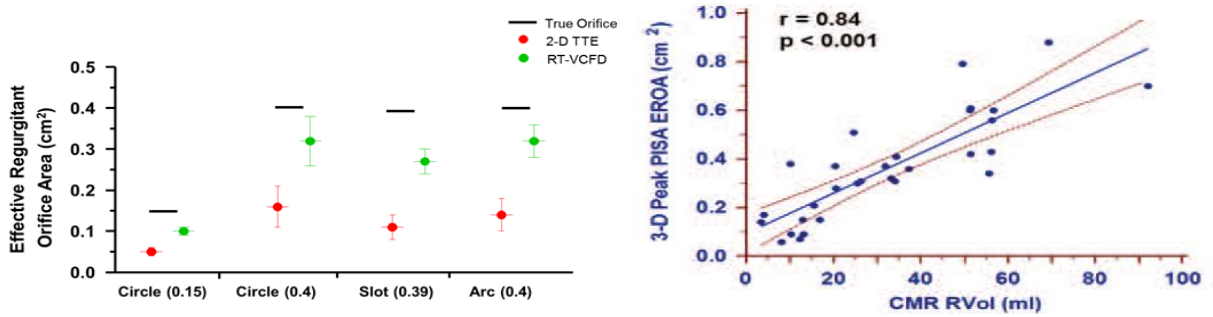


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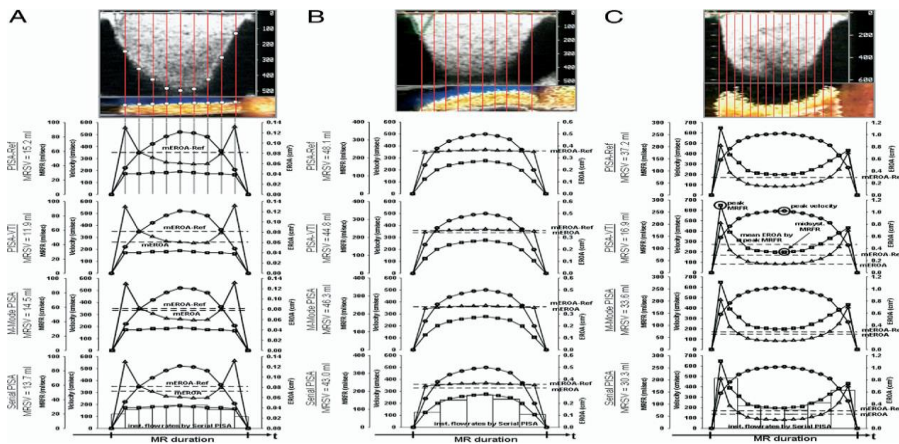


Functional MR (N=30), TTE  
Thavendiranathan et al. Circ CV imaging 2013, 6(1): 125-33

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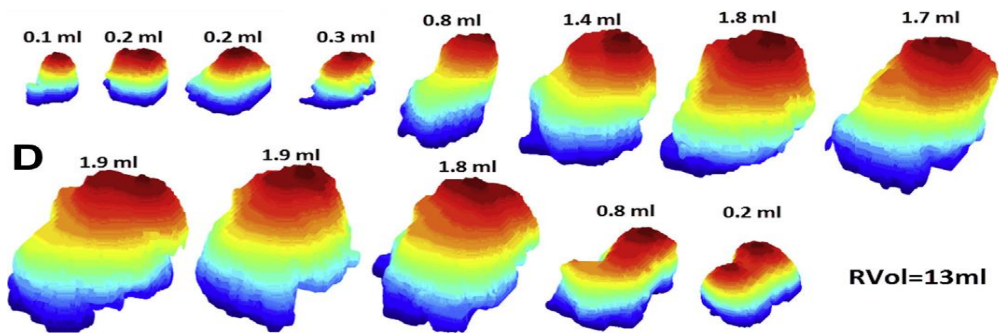


Buck T et al, JACC 2009; 52:767-78  
Hung J et al, JACC, 1999; 33:538-45

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## 3D Color Doppler - PISA

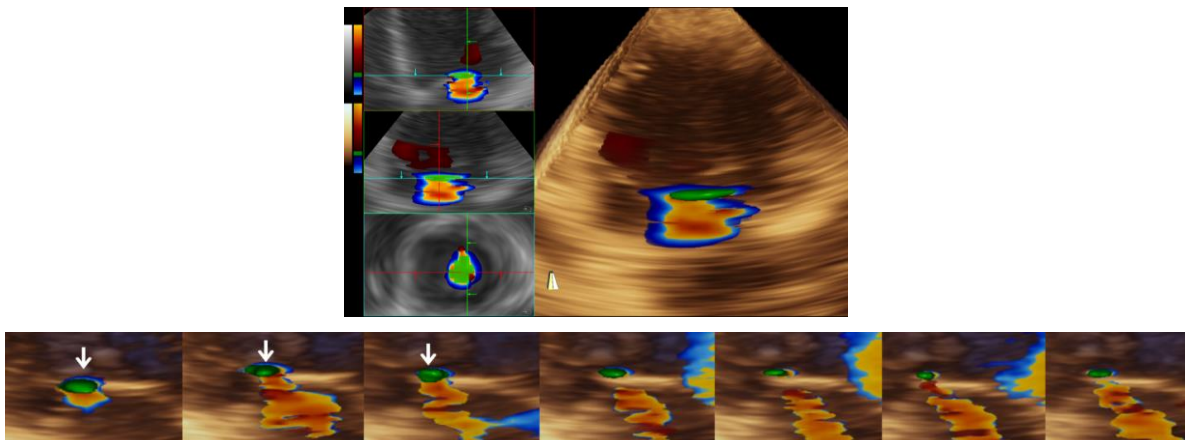


Brugger N et al, AJC, 2015: 1130-1136

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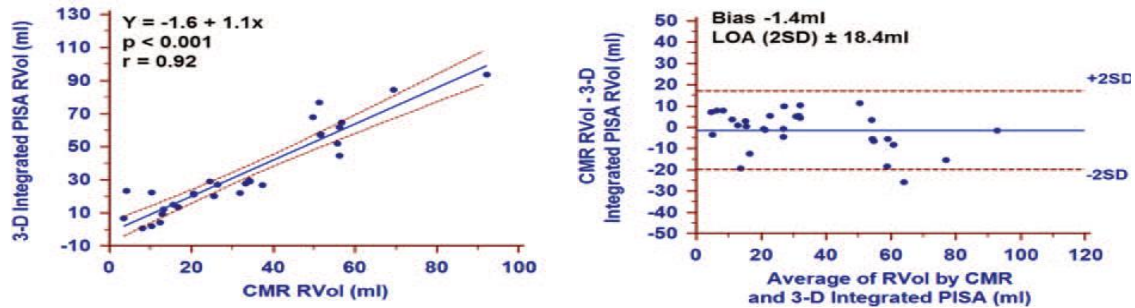


Thavendiranathan et al. Circulation cardiovascular imaging 2013, 6(1): 125-33

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## Summary

- Several new techniques for MR quantification
- None with as much experience as 2D techniques
- No prognostic data
- Allow quantification with minimal assumptions (flow, shape, dynamic orifice)
- Compares well to “reference” methods / Better reproducibility
- More clinical experience / vendor neutral software / validation before clinical use

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Thank you

